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SCIENCE DIGEST

OLYMPICS

THE PHYSIOLOGICAL LIMIT

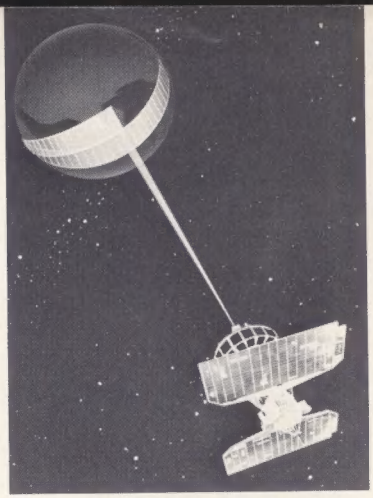
WHY JET TRAVEL MAKES YOU TIRED

The secrecy behind the NOBEL PRIZES

OUR NEXT BIG STEP IN SPACE

A timely discussion of the PSYCHOPATHOLOGY OF POLITICKING

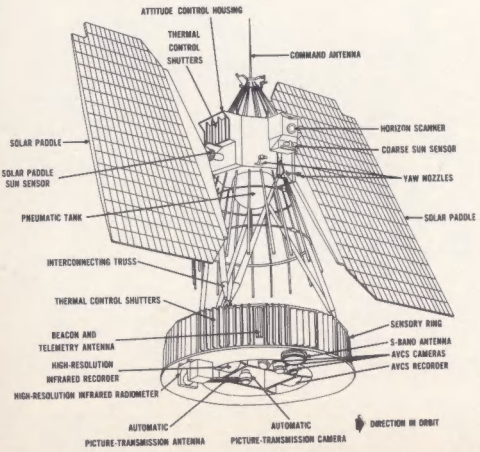
World's largest weather satellite



Nimbus-A was designed to photograph entire earth's weather every 24 hours.

AN elaborate complex of cameras weighing 830 pounds and scanning the entire cloud cover of the Earth every 24 hours, in sunlight or darkness. That's about the size of the largest weather satellite ever built, scheduled for launching this summer.

Nimbus-A, meteorologists have estimated, can do the work of hundreds of thousands of ground-based weather stations. It far exceeds the capabilities of the earlier TIROS weather satellite. Its eight-foot-high solar panels (see diagram below) provide power to the sensory ring carrying the camera systems and high resolution infrared radiometer (HRIR). The advanced vidicon camera system (AVCS) provides high resolution pictures of improved quality over the TIROS pictures. And HRIR is designed to send back pictures of the dark side of the Earth of a quality comparable to TIROS's. Nimbus is also equipped with an automatic picture transmission system to provide cloud cover pictures to relatively inexpensive ground receiving stations around the world.



In contrast to TIROS, which is spin-stabilized, Nimbus is Earth-oriented and stabilized in all three axes. Its cameras always point toward Earth and its attitude control system keeps its solar paddles pointed at the Sun to receive solar energy. Scientists receive pictures 90 seconds after they are taken.

SCIENCE DIGEST

Twenty-eighth year of publication

Photo: Phil Bath

Fred Hansen pole vaults 17 ft. 4 in. to set a new world record at the U.S.-U.S.S.R. meet at Los Angeles last July. Is the physiological limit 20 feet? For scientific estimates of "ultimate" track and field records see the story starting on page 6.

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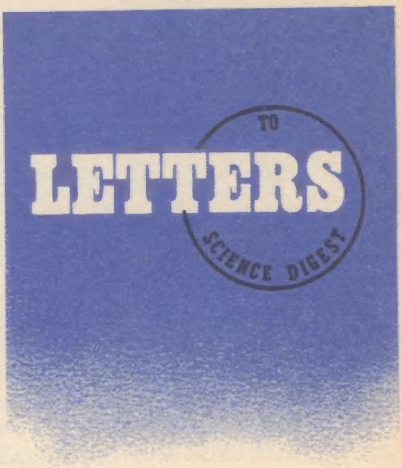

Religion and Healing

Your article, "How Religion Helps to Heal" (July '64) by A. J. Snider, comes as a shocking disappointment in your otherwise comparatively fine magazine. A more appropriate title for the article would be, "How to Treat Disease or Lunacy With More of the Same."

HERBERT KOLLER
Vancouver, B. C.
Canada

I do not berate magazines for printing articles with which I do not agree, nor do I stop buying them in fits of anger at such articles: I buy, or don't buy them according to their overall value to me.

But every now and then it is necessary to give the editor a little hell when he seems to be straying from the policy which makes a magazine worth reading. I'm thinking of "How Religion Helps to Heal."

At the very most, this article (condensed) might deserve printing as

part of a double-header, pro and con. Presented by itself, it is an offense to anyone—and I had the impression such were *Science Digest's* intended audience—accustomed to impartial, rational judgement.

The author is not a reporter, he is a rabid partisan. The fact that the opinions expressed are all couched as quotations (all, of course, from his own side of the fence) does not mitigate this; neither does his style, and admittedly impeccable imitation of that used by modern suburban preachers of the no-particular-creed, name-no-names persuasion.

He does us a service, of course, by showing just how extraordinarily condescending and narrow-minded the clergy is on this issue. But this is far outweighed by the disservice he does the medical profession by implication from his carefully slanted statements.

ANTHONY BUCKLAND
Vancouver, B. C.
Canada

Man is an unpredictable mystery, and science by now should be used to surprises. Please then, let us not condemn something we admittedly know nothing about and publish it as a fact in the name of science. The psychic field is being explored with great interest by many intelligent minds. Rev. Dr. Paul B. McCleave is quoted in your article "How Religion Helps to Heal" as saying, "I would like to know what happens to them (patients who have gone to faith healers). No doubt their cancer or their alcoholism becomes worse." He admits that he doesn't know what happens to them.

Let us not be so smug and lazy and cozy in our theories. At this

WHO'S A WHY-ASKER?

You probably are, for one — or chances are you wouldn't be reading SCIENCE DIGEST.

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point, we need men who are willing to gather empirical evidence, not issue dogmatic statements.

CAROLINE CARRERA
Arlington, Va.

Psychiatry and the soul

Three articles in the July issue demonstrate the popular interest in subjects which are purely speculative: "How Religion Helps to Heal," "Do You Need Eight Hours Sleep?," and "Inside Psychiatry Today."

Psychiatry is not science. It is either a substitute for religious teaching, or it is the religion of atheism.

In the first place, modern psychiatry is undisciplined. It does not seriously suggest the possibility of a higher power and authority than the human mind. It assumes that the physical brain and the mind of man are one and the same thing. It then proceeds to attribute all spiritual, emotional and mental joy or suffering to physical phenomena, even as Darwin attributed the almost divine nature of man to the process of digestion and reproduction.

Man is a spiritual being created, and still in the process of unfolding, in the image and likeness of God. The enduring spirit has taken on many forms; and man is that highest form, that highest center of this universal spirit, with all its memories, all its instincts, all its past experiences. This is the whole man, the eternal living consciousness. This is the soul-mind which psychiatry cannot recognize. It cannot be counted, measured, analyzed. It cannot be classified, and its thoughts reduced to specific formulae, acting in certain ways under similar conditions as a unit, an animal without self control.

C. B. SMITH
Arlington, Va.

"It's a lot more serious than you think—he's my psychiatrist."

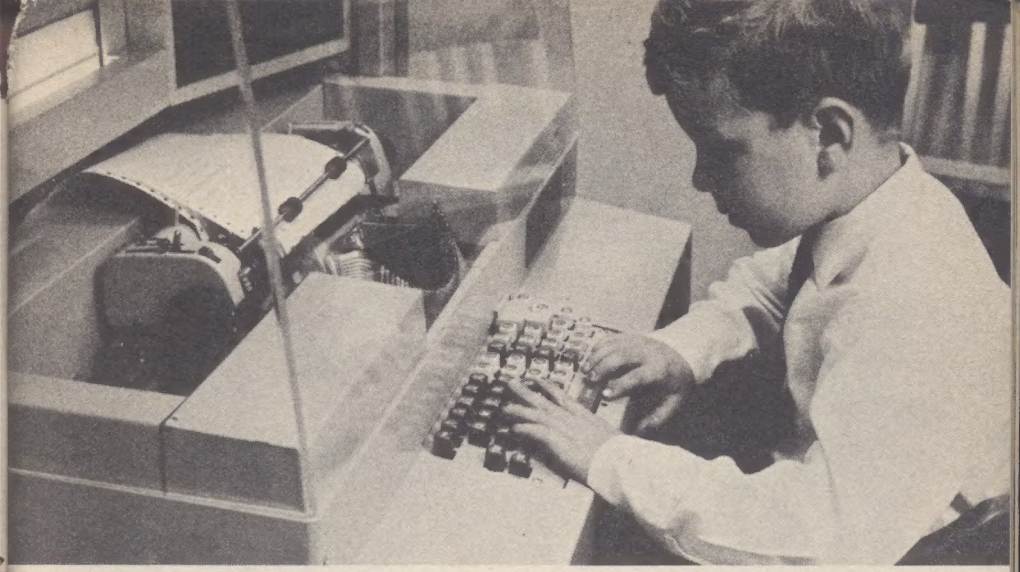
Harmless additives?

Honestly now, are all those food additives mentioned in "What Do Those Food Labels Mean?" (Aug. '64) as harmless as the authors imply?

With all the talk of the potential harmfulness of insecticides in our food and drink, as shown in the article "Was Rachel Carson Right?" in the same issue, I feel we all have a right to know even though we can't do much about it at present.

As a frustrated scientist I love your magazine.

MRS. BERTHA GORDON
New York, N. Y.



Learn to read in 30 hours

TWENTY Freeport, N.Y., kindergarten children have learned to read at a second-year level after 30 hours of instruction. Each had an individual tutor, of course, but the tutor is a machine.

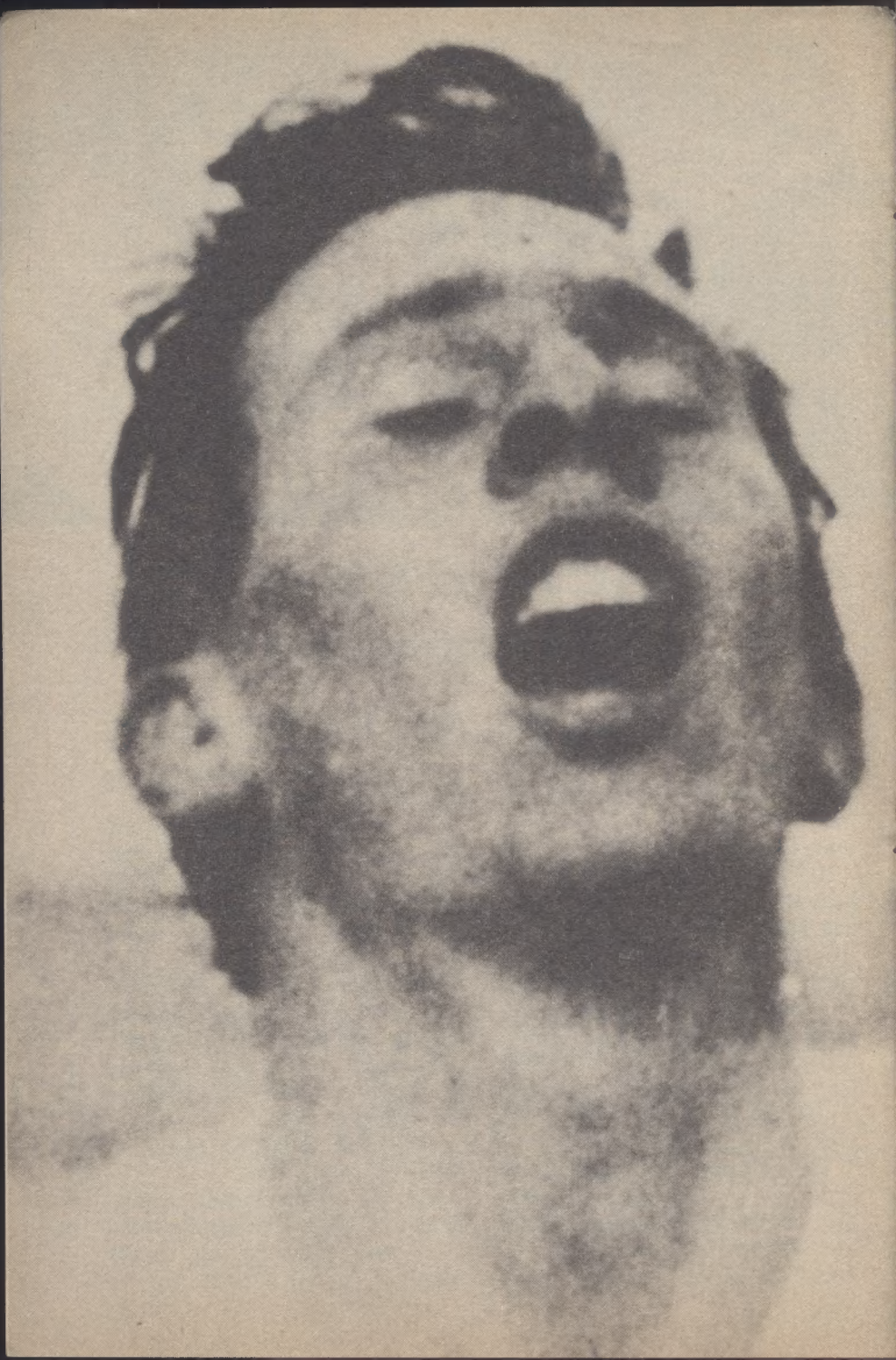
At first, a child is free to peck at keys at random. The machine prints and pronounces the letters. Pretty soon the machine starts asking the child to type certain letters. His fingernails, painted to match the keyboard, give him a clue. All keys except the right one are locked. The machine combines the letters into words and pronounces them, then goes on to sentences.

The machine can point out letters and words on a moving printed display above the typewriter. It links words to known objects with pictures flashed on a screen to the right. When a child is asked to pronounce, the machine records his answer and plays it back so he can compare it with the model.

The child is always on his own. The whole thing is very low pressure. One 5½-year-old liked the machine teacher better than a human teacher "because I can run it with my finger."

The designers of the machine, the McGraw-Edison Co. have working for them the learning capacity of a child which is at its peak from two to five. They also depended on early-learning methods worked out by Professor Omar K. Moore of Rutgers U. and others.

Over the five-month test, the machine tutor pushed its pupils ahead of an equal group getting regular instruction by 1.7 months.



Olympic Records... where will they end?

How fast can a man run or swim? How high can he jump? What records are most likely to fall at this year's Olympic games? Here is what science knows about an athlete's physiological limits and how close he can come to reaching them.

by Bruce H. Frisch

AT THE 1960 Olympic Games in Rome, 18 men's track and field records fell. Since only three of these are now world records, a host of new marks should be set this year at Tokyo. Every "insurmountable barrier" seems made of tissue paper — the four-minute mile, the 16-, then the 17-foot pole vault, the seven-foot high jump, the 60-foot, then the 64-foot shot put. Where will it stop? Aren't there any limits?

Scientists take physiological limits for granted, but have trouble deciding exactly where they are. One of the first attempts to calculate ultimates by more than hunch was made in 1906 by A. E. Kennelly. He plotted curves of the world records and from them predicted the possibility of the 3:58 mile set in 1954. He replotted his curves in 1926. Other men have published their own from time to time up to 1956.

Wide World

Roger Bannister broke the four-minute mile in 1954. His secret was powerful lungs.

The most extensive conclusions were drawn from them by Professor A. V. Hill of the U. of London in 1925. He plotted on log-log paper average speed for the race versus time to complete the race. He graphed men running, walking, swimming, bicycling, rowing and skating, some women's races and some horse races. Each group, such as men running, fell approximately on a straight line, and all the lines were parallel.

Some records fell slightly below the line. These, he figured, were not quite up to the general level of performance being set at that time and were most vulnerable to being broken.

As the years passed men reached a new level of performance and the line rose. Hill found little difference, however, between the horse-racing

Short- and middle-distance men can run now, breathe later. A 100-yard dash man holds his breath the entire race, and his ability to run without air can't be improved by training.

records of 1721-1832 and 1880-1905. "The horses of 150 years ago could run just as fast as their modern successors," he concluded, questioning claims that selective breeding has improved race horses.

This finding backed up the idea of a limit for humans.

Since all the lines of performance were parallel, Hill felt that there was a common fatigue mechanism working in all events and in both humans and horses.

Oars are gears

Thus, although bicycling speeds were about twice those for running at the same distances, cyclists tired at the same rate as runners. Hill explained that the gearing reduced the speed of the legs for better muscle efficiency. His work in physiology had led him to believe that one maximum effort per second was most efficient.

Oars in rowing act just like gears. Their length has evolved until the customary stroke count is 30 to 40 per minute. Thirty strokes per minute gives 60 movements per minute or one per second, counting the stroke as one movement and the return as another.

As speed goes up, efficiency falls. Hill estimated that the energy consumed in a race went up approximately as the square of the speed. To use the minimum energy, or conversely, to get the maximum average speed out of a limited amount of energy, a racer should maintain a perfectly even pace.

Years later, in 1954, Franklin M. Henry in the Department of Physical Education, U. of California at Berkeley, tried to look further into the law of fatigue Hill had thought was buried in the record book. Henry graphed world records for men running by plotting average speed vs. the log of running time and drew a smooth line through the points. As before, records below the line were the most vulnerable. At the peak, around 200 yards, runners made their fastest average speed. Speed dropped toward the shorter distances because of the start.

Henry assumed that "maximum speed in running is limited by the energy reserves available for conversion into work." He set up an equation giving speed in terms of four sources of energy in the body minus energy expended in overcoming the resistance of the muscles themselves.

The body first calls on a readily available but quickly expended source of energy, then successively depends on less and less powerful but longer and longer lasting energy

Wide World

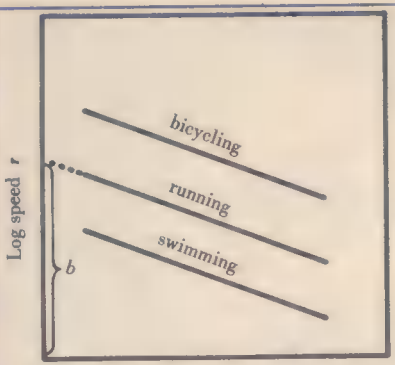
Russia's Valery Brumel holds the world's high-jump record at 7 feet, 5½ inches. His faster approach gives him more kinetic energy to convert to height.

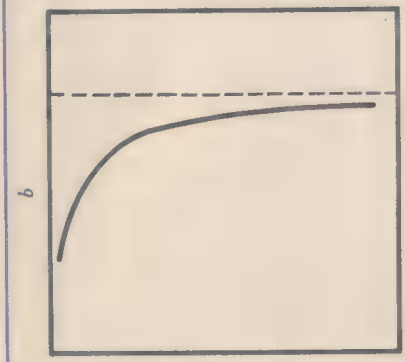
reserves. Henry juggled the size of all the factors to make the curve of his equation fit the curve of running records.

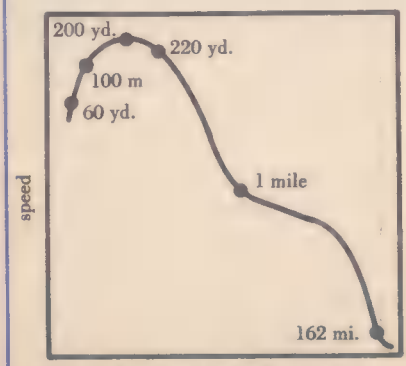
If the true values of all the factors in Henry's equation were determined by experiment, it might be possible to draw a curve of the theoretical ultimate records. We can't do that yet, but we know enough about the athlete as an energy machine to get a more general idea of what the limits might be.

His fuel is blood sugar, glucose, which is oxidized into pyruvic acid to produce energy. Some glucose is stored in the liver and muscles as glycogen. When needed, it is converted back into glucose. Blood sugar and glycogen deliver quick

(Text continued on page 11)







The mathematics of speed

World's records for races depending on muscle power fall approximately on a straight line when plotted log of average speed versus the log of distance or log of elapsed time. Short distance records depart from a straight line because of the standing start. Records that fall below the line are most vulnerable.

The formula for the curve is $\log r = b - a \log t$ (or d). As records improve, the curve rises and b increases. If records approach but never reach a limit, b will behave as at left.

A straight line may be an oversimplification. In a different approach, track records are plotted average speed against log of time or distance (just to compress the graph). The bumps and dips are seen as being in step with energy flow in the body. A formula for speed is set up in terms of energy flow from four sources in the body and the wasteful absorption of energy by the muscles, all as a function of time. It is then fitted to the record curve. The formula has the form: speed $= a_1 {}^{-k_1 t} + \ldots\ldots + a_4 {}^{-k_4 t} - a_5 {}^{-k_5 t}$. The symbol t is the elapsed time since the beginning of the race. Each of the four stores of energy has a characteristic constant a and a half-time k which is the period in which half the store of energy is used.

energy at a high rate, and are the main sources for all but the longest events, when the body falls back on its fat. Fats deliver energy at a much lower rate, but in the end may furnish two and a quarter times as much.

An athlete can consume glucose faster than he can supply oxygen by turning it into lactic acid. Eventually lactic acid must be oxidized or neutralized by buffers in the blood. He can postpone the oxidation until later and let the acid build up to an amount requiring about 15 liters of oxygen. This is called his oxygen debt.

An increasing concentration of acid causes increasing discomfort until finally the muscles don't respond. This we call fatigue.

One-hundred-yard-dash men run entirely on the oxygen debt. Most hold their breath during the entire race, because it is anatomically easier to run with the chest held high and the abdomen tensed.

Hill estimated that a runner cannot exhaust himself completely before about 50 seconds or one quarter mile. At shorter distances he is not limited by his supply of energy but by how fast he can use it. That's why Roger Bannister, the first man to run a four-minute mile and also a physician, says, "Sprinters are born, not made." Their ability to run without air can't be improved by training.

As the race becomes longer, the oxygen debt becomes less important. Middle-distance runners depend more on their oxygen intake and long distance runners depend on it almost entirely.

Second wind is when oxygen intake equals oxygen consumption and the runner has stopped piling up an oxygen debt. M. H. Lietzke, a chemist at Oak Ridge National Laboratory, gives it credit for the second bump on the record curve.

From these facts, it is tempting to conclude that the limit is the normal top breathing capacity of the lungs, about four liters per minute. But great athletes are not normal.

Champion inhalers

Thomas K. Cureton ran 200 champions through the Physical Fitness Research Lab at the U. of Illinois. In one test, they ran to exhaustion on a treadmill. They lasted an average of 2.59 minutes compared to 1.70 minutes for normal young men. One reason for their superiority was that they could take in 16 percent more oxygen. Roger Bannister had the highest oxygen intake rate of anyone tested. He was also the weakest. In fact, Cureton found the athletes highly specialized for their own events.

More importantly, they used their oxygen more economically so needed less. The end result was that they could meet their reduced oxygen expenditure more completely with their higher oxygen intake, went more slowly into oxygen debt and therefore reached their limit later. Partly this is the learned econ-

Some athletes would rather eat their way to records than train, but an American Medical Association panel declared, "There are no magic foods which produce super power or agility."

omy of movement that makes the best performances seem effortless.

These are the gains of training. Trying to push themselves closer to the limits, many athletes have adopted sterner and sterner training routines. Sometimes their announced aim is to increase their lactic acid tolerance. Yet Cureton found that his 200 champions could not force themselves into a greater oxygen debt than ordinary, unheroic college students. Japanese athletes, who have traditionally practiced their events until they dropped, have lost patience with these methods. The Japan Amateur Athletic Association has sunk $6,000,000 into a study to find training methods that will give better results.

In 1954, the Australian John Landy strained to break the four-minute mile by running twenty miles a day. He was one of the early members of the hard-training school. Roger Bannister, on the other hand, limited himself to a half hour's practice a day in 1953 and upped it to an hour in 1954. He didn't believe in any more training than he enjoyed. He also concentrated on saving energy by running at constant speed except for a kick in the last 300 yards from the tape.

Bannister beat Landy to the four-minute mile and defeated him when they met in a race at Vancouver. Bannister claimed that, "it is neither necessary nor desirable to spend unlimited time and energy" on running. Excessive training hastens recovery, "but it has yet to be shown that performance is better on the day of the race."

Long-distance events are physiologically much more complicated. The runner suffers a drop in blood sugar, nervous fatigue, dehydration, lack of salt, perhaps has metabolic disturbances and a disrupting rise in body temperature. An attempt to gauge a physiological limit is nearly impossible at present.

Hill and others who studied the straight line log-log curves consistently noted that the records drooped far under the line at longer distances. They felt the records were poor because runners neglected these races. Their critics cited the departure as proof the curves were invalid. Today we are finding that hard training works in the endurance races and expect these records to show the most spectacular advances. At long distances, Bannister says, "we are just beginning to realize the amount of training the body can endure."

Training for field events is done with a quite different aim, to perfect form. Records have improved in jumps. A new advance in form

brings a sudden big gain. Then there is a lull after everything has been squeezed out of the new style until a newer twist comes along.

By mechanical analysis, Geoffrey H. G. Dyson, the chief national coach of the British Amateur Athletic Association has cut through the welter of styles to the basic possibilities. In high jumping, for instance, the Olympic record has improved over two feet in 64 years, but the jumpers have never raised their centers of gravity more than about four feet. By crossing the bar lying flat out they have learned how to pass over a higher bar without really making a higher jump. Tall jumpers are at an advantage because their centers of gravity are higher to begin with.

It's all in the sprint

Pole vaulters clear great heights because the vaulter converts his running momentum into vertical lift with the addition of some spring at the bottom and push-off at the top. A top sprinter going 36 feet per second should be able to clear about 20 feet. Of course, the pole slows him down, but lighter poles like the new ones of fiberglass have allowed faster runs. Cornelius Warmerdam introduced a longer run in which he could gain a higher speed. High jumpers are also trying faster approaches now.

The pole-vaulting record has risen almost five feet and may go up another foot and a half to 17 feet this year. One advantage of the new fiberglass pole is that it conserves some of the vaulter's kinetic energy. It absorbs energy by bending at the beginning and returns it when it straightens at the top.

A perfect combination of the 36-foot-per-second sprinter and the seven-foot high jumper who has a vertical velocity of 16 feet per second would make a 36-foot broad jumper. A perfect combination is impossible. For one thing, the broad jumper can spend little more than half as long pushing off as the high jumper. He tries for the best compromise, but may limit himself by his 120-to-140-foot approach run. Dyson points out that sprinters don't hit top speed for 180 feet.

R. J. Whitney has suggested a very simple limit in weight-lifting—the counterweight effect of the lifter's body.

Other events can be similarly analyzed, if not as neatly.

Some athletes find the idea of eating their way to a record much more pleasant than training for one. The first of the ancient Greek Olympic competitors put their faith in a vegetarian diet. A nineteenth-century British distance runner hopefully stuffed on mutton, stale bread crusts and old beer. Today's athletic fad foods have more scientific names but amount to the same wishful thinking.

In 1953, the Council on Foods and Nutrition of the American Medical Association sponsored a study of sports nutrition. It found: "There are no magic foods which produce super power or agility."

Jean Mayer and Beverly Bullen

of the Department of Nutrition, Harvard School of Public Health, brought the subject up to date in 1960. They checked diets containing extra protein or supplements of vitamins A, B complex, C, E and wheat germ oil. They looked into the worth of gelatin in adding to an energy reservoir in the muscles and alkalinizing agents for neutralizing lactic acid. In every case, the facts were negative or inconclusive. In short, "Any well-balanced diet is all that athletes actually require for peak performance."

"Yeah," the wise-guys of the locker room may concede, "but how about drugs?" Drugs are banned from the Olympics. A Danish bicycle racer died at the Rome games in 1960. Reports said he had taken drugs, but a Danish committee declared later that he had died of a heat stroke. A massive investigation of drugs in sports is going on right now in Italy. Mayer and Bullen cautioned that caffeine, by simply masking fatigue, might lead an athlete beyond his limit of endurance.

To clear up the issue, the AMA set up a special Committee on Amphetamine and Athletics. A review of scientific literature turned up no sound evidence that amphetamine (benzedrine) improved performance, but the committee commissioned two new experiments with the drugs secobarbital and amphetamine.

Secobarbital was really bad. Athletes thought they were doing better when they were doing worse.

The data on amphetamine were more ambiguous. One tester found, in general, no effect either way. Another tester reported a genuine improvement in performance.

There is no doubt, however, about the big jumps in performance made possible with better equipment. Pole vaulting went from wood to bamboo to steel to fiberglass poles. Runners wear lighter shoes. High jumping and pole-vaulting pits are softer and safer and inspire more confidence. Other examples are asphalt runways for javelin-throwers and jumpers, starting blocks, the elimination of waves in swimming pools, a concrete ring for shot put and discus, and springier tracks. But what better equipment does is not break through physiological limits; it knocks down artificial barriers to reaching the limits.

The limits are still there. Wonder foods can't breach them; drugs may. Training can do little to bring the sprinter closer to them, but is more effective at middle distance and best in endurance races.

The limits are difficult to set with accuracy. Brutus Hamilton of the U. of California and head Olympic coach predicted 26 ultimate records in 1934. Nineteen have fallen. His example makes men cautious. And even if there are physiological limits, that doesn't mean there is a limit to how long records will be set. Roger Bannister thinks they will go on forever, creeping closer and closer to the limits, but never getting there.

What we know about the moon now

by Bruce H. Frisch

THE city of St. Louis could be sitting on the moon, and we wouldn't be able to recognize it through a telescope. Nothing smaller than 3,000 feet across can be seen on a moon picture taken from earth. At this resolution, Air Force experiments with serial photographs show, the streets, rivers and buildings of St. Louis dissolve into a featureless blur. This is little help to an astronaut interested in what the surface of the moon is like on a man-sized scale, and is the reason for Ranger.

The last picture taken by Ranger 7 before it hit the moon on July 31 shows objects down to one and a half feet, good enough to outline a crater three feet across.

Previously, scientists had resorted to indirect methods of doping out the moon's surface. They found that the moon reflects seven percent of the light hitting it. They found that the surface is hot enough during the day to boil water, but cools abruptly during an eclipse. An inch below, radio microwave probes measured practically no temperature variations. When observed with radio microwaves from about nine feet to four inches in length, the moon appeared smooth and undulating. At shorter infrared wavelengths, the surface seemed rough. At the wavelengths of visible light, the surface also seemed rough. Thus when the moon was full, the edges were just as bright as the center. Objects smooth to visible light, such as an egg, had a dark outline.

A layer of dust seemed to fit all these facts. It would be smooth on a large scale, with a rough, matte surface on a small scale. It would be an excellent insulator, making it hot on top, cold below. Estimates of the thickness of the layer ran from zero to miles.

But steep slopes should be bare and should polarize light differently from dust-covered flats. Observations showed they did not. Though the observations were not considered positive, one could still take this as evidence against dust. Following various theories on how the surface was shaped then led to many bizarre, but legitimate, conclusions.

Dr. Charles R. Warren, from the Military Geology Branch of the U. S. Geological Survey, thought the surface was a skeletal fuzz "about one inch thick, that consists mostly of open space. The structure could be a mesh or a Tinker-Toy structure, or it might resemble that of snowflakes or reindeer moss."

A British astronomer, V. Axel Firsoff, suggested that "the lunar surface was completely encased in frothy rocks, lighter than water,"

Resolution similar to what had been obtained from the ground appears in this Ranger 7 shot taken 480 miles from the moon. Box marks the craft's landing area.

composed of volcanic glass which swelled 20 to 50 times its original volume when it spewed out into the vacuum.

A similar kind of rock was pictured by a Russian group. They called it "lunite" and estimated it had an average thickness of 90 feet.

The dark, smooth areas called maria or seas by Galileo, were the subject of a few special theories. It was in a mare, the Sea of Clouds, that Ranger 7 landed.

Maria are the lowest areas on the moon, so were likely spots for true seas if there was water. A British-born Princeton U. scientist, John J. Gilvarry, claimed there once was and it has since evaporated, leaving behind remains of living things.

Dr. Thomas Gold at Cornell U. sketched, instead, a sea of dust slowly flowing like a heavy liquid by electrostatic repulsion.

The seas do have a flooded look. The most widespread explanation is that they are filled with lava flows.

Ranger 7 took pictures down to 1,000 feet above the surface and sighted craters of all sizes down to three feet in diameter. Some had sharp edges and some had rounded edges.

As the pictures were first shown to the press, Dr. Gerard P. Kuiper, Lunar and Planetary Laboratory of the U. of Arizona, and Dr. Eugene Shoemaker of the U. S. Geological Survey gave their impressions after studying the pictures about two hours.

Dr. Kuiper said, "I had, myself, frankly expected something that has not shown up, namely that the lunar surface on the maria, that is, on these lava fields, would have a lot of furrows and cracks, fissures.

"We are not dealing here with

enormous layers of dust. . . . It is not like sand. . . ."

He then explained the rounded edges of some craters by saying, "The moon is constantly being bombarded by large and small particles . . . so there is a constant rain on the moon, and naturally this has the effect of erosion and will cause a softening of the lines. . . .

"The surface is basically a lava surface, although rounded by this rain of small particles so that the upper few inches and maybe as much as a foot would be modified by these impacts," which Dr. Shoemaker said would produce a "very porous upper layer which does not extend a foot and a half in depth, but only extends probably at this place a few inches. . ." He added, "I still feel [the lunar surface is] probably composed of debris."

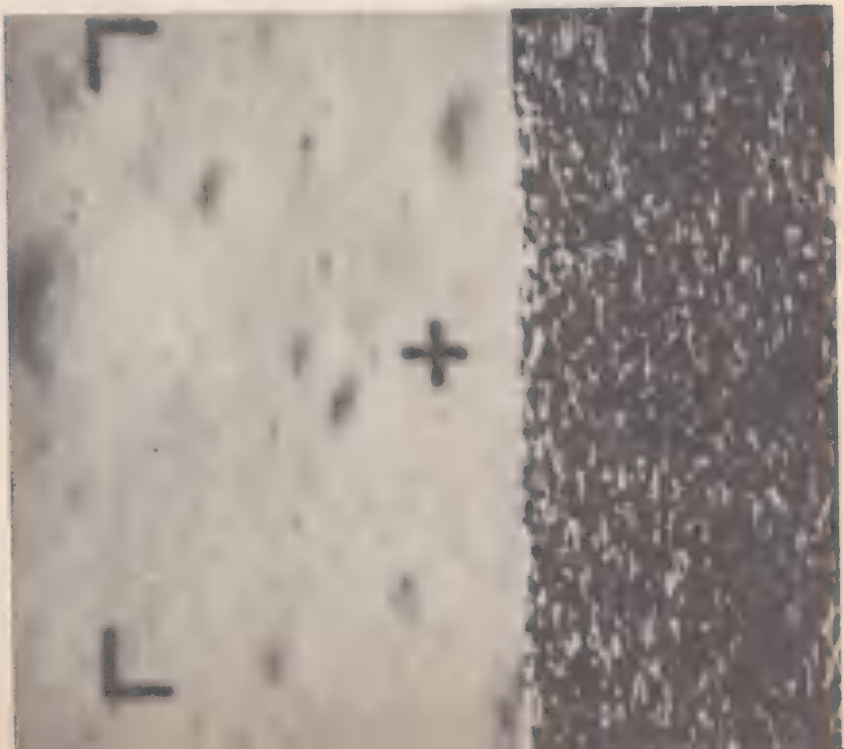
Asked if he would be afraid of going right through if he put his foot down, Dr. Shoemaker said, "I don't think I would be very worried, no."

Five days later, Dr. Kuiper told Congress, "I am willing to bet that if you walked on the moon it would be like crunchy snow." A silent crunch, of course, in the vacuum.

A slightly different interpretation came from Dr. Fred C. Hess, associate astronomer at the American

"A remarkable clustering of very small craters" grows out of the light mark in the previous box. It is part of the ray from a large crater and "poison" to an Apollo landing.

"An enormous fragment" about 300 feet long lies uncovered in the dark crater at the left (above), proving that the soft top layer of the moon is thin. Craters at right showed up in the preceding box. "The last gasp of the spacecraft" is the picture below taken from 1000 feet and cut off during transmission by the impact.



Museum-Hayden Planetarium in New York. He felt "it would be in the ball-park" to compare the surface with loess, a yellow, clay-like material covering the Midwest which is firm and compact but not hard like a rock.

The pictures failed to prove that the sea is a lava field, he felt, because there was "no evidence of the sort of flow patterns one would expect from a lava field."

This is a sensitive point among scientists, because some say the surface of the moon has been carved mostly by volcanoes, while others say the moon is volcanically dead and has been shaped mostly by meteorite impacts.

If the moon has volcanic activity, Dr. Harold C. Urey of the California Institute of Technology thinks the source of heat may be radioactivity, as it is on earth. An even more powerful source of heat has been suggested by Dr. Zderek Kopal, an astronomer at the U. of Manchester, England. He calculates that tidal forces on the moon are 100 times those on earth. This may heave the surface up and down by 15 feet each month to produce internal temperatures by friction of 1,000° C to 2,000° C.

In 1959, Nikolay Kozyrev, a Soviet astronomer, sighted what looked like gas escaping from the crater Alphonsus. At least six scientists have seen red or pink spots, which are sometimes glowing or sparkling, in Alphonsus or the crater Aristarchus. On the basis of spectrographs, Kozyrev has decided they are caused by hot volcanic gases containing hydrogen. Dr. Kopal and Dr. Thomas W. Rackham, also from the U. of Manchester, have a non-volcanic explanation. They say the red spots may be the luminescence of materials on the surface of the moon under the bombardment of particles from solar flares.

Whether they are volcanic or meteoritic, Aristarchus and other large craters are at the center of light colored rays hundreds of miles long. Ranger 7 landed right on top of one from Copernicus. The photographs revealed, said Dr. Kuiper, that the debris thrown out of the moon to make the rays had been made up of more than the light, fluffy material often suggested in the past. It had included "some pretty sizeable rocks, able to make secondary craters in great numbers. These areas by and large would be rough."

For landing craft, "one type of terrain that one should avoid like poison is these crater areas."

On the other hand, Dr. Kuiper was encouraged by his estimate that primary craters from which the rocks come cover only about one percent of the surface.

This means there should be plenty of smooth spots to land Surveyor in late 1965 or 1966. Two more Ranger flights will come first.

"There is no way we can measure directly the bearing strength of the lunar surface without putting something down on the lunar surface and patting it, so to speak," says Dr.

Shoemaker. Surveyor will have a mechanical arm to do just that. It will also scrape furrows and hold up pieces for two television cameras to look at. The cameras will look at the rest of the vicinity too; a seismometer will measure moonquakes, and a detector will tally micrometeorite hits.

In 1966, Lunar Orbiter will orbit low over the 25,000-foot mountains to photograph the gaps between the Ranger and Surveyor local landings.

Finally, manned landings are scheduled for 1970. The Lunar Excursion Module in which two astronauts will land from an orbiting Apollo spacecraft can remain upright if one leg drops into a crater as deep as 24 inches. The smallest craters seen in the Ranger 7 pictures are about 18 inches deep.

Dr. Kuiper noted one big gap left by Ranger when he said, "I think that the theory of the moon is not immediately affected by these observations."

That may have to wait until a landing by the astronauts, who are being trained in geology.

As Dr. Urey says, only men standing on the moon can grasp the significance of its many and complex phenomena.

The men who shot the moon

THE LONG-DELAYED but finally successful effort to get close-up photographs of the moon was the work of a dedicated group of men who make up the Jet Propulsion Laboratory. The laboratory, a branch of the California Institute of Technology in Pasadena, works for NASA.

Dr. William H. Pickering, director of JPL, heads an organization that has scored brilliant successes in the instrumented exploration of outer space.

For the Ranger project, one of JPL's programs whose beginnings were less than brilliant, the laboratory in December, 1962, called in Harris McIntosh Schurmeier. Forty-year-old Schurmeier, the project's manager, has about 400 people working under his supervision. His biggest contribution to the Ranger, aside from coordinating all the details of the project, was to rid it of unnecessary complexities and concentrate on getting good shots of the moon's surface. As an aeronautical engineer, Schurmeier has worked on the Ranger, Surveyor and Mariner space exploration programs.

Schurmeier has spent his entire professional life at JPL, after graduating from Cal Tech in 1945 and taking two years of postgraduate work there. He had previously been a Navy pilot.

The business end of the Ranger project, the six television cameras, is the responsibility of Bernard P. Miller of RCA, which built them. The cameras, a complex weighing 382 pounds, were designed and built by engineers and technicians at the Astro-Electronics Division of RCA at Princeton, N. J. Thirty-six other subcontractors have worked on the Ranger series, from Ace of Space, Inc., Pasadena, to X-Cell Tool and Manufacturing Company, Hawthorne, Calif. Twelve hundred other concerns also contributed.

The mystery of the biological clocks

Why do flowers bloom in the spring? How do birds know it's time to fly south? Why do you feel more active at certain times of day? Scientists are beginning to unravel the riddle of nature's built-in timepieces.

by Andrew Hamilton

All living things seem to be able to tell time. How, has long been a puzzle. Today, a handful of scientists are studying the relationship between the earth's 24-hour day-and-night cycle and these mechanisms, popularly called "biological clocks."

There are two distinctive features of the ability of plants and animals to measure the passage of time:

"Circadian rhythm"—from Latin meaning "about a day." In biology, this refers to patterns of rhythmic

activity which repeat themselves in living organisms almost every 24 hours. Examples are cell division, respiration, photosynthesis, metabolism and physical activity whose high and low points can be predicted and plotted on curves.

"Photoperiodic response"—response regulated by the period of daylight. This means, in effect, that plants and animals have inherited a "memory" or knowledge equivalent to our calendar. When a day is a certain length, they know it is time to flower, to fly south, or to grow winter fur.

Upsetting the rhythm

The existence of circadian rhythms and photoperiodism has been demonstrated in many ways. Dr. Karl Hamner of the University of California, Los Angeles, exposed soy bean plants to 8 hours of light and 16 hours of darkness, a full circadian cycle. At the end of such treatment, the plants flowered. When the period of darkness was lengthened to 24 hours, making the cycle 32 hours long, no flowering occurred. The circadian rhythm had been upset.

But flowering took place when multiples of 24 hours were used. For example, flowering occurred after 8 hours of light and 40 hours of darkness (a 48-hour "day"), and also after 8 hours of light and 64 hours of darkness (a 72-hour "day").

"This proved," said Dr. Hamner, "that a plant needs a full 24 hours, or a multiple thereof, for normal development. No amount of experimentation has been able to slow down or speed up this rhythm or to affect its regular order."

The most that can be done is to re-phase the cycle—to make a plant begin earlier or later than normal. For example, when commercial flower growers want short-day flowers such as chrysanthemums for Mother's Day, they expose their greenhouse plants to longer periods of light in the winter to prevent flowering until Mother's Day approaches.

Dr. Beatrice W. Sweeney, a research biologist at the University of California, San Diego, likens the clock mechanism to a housewife's automatic timer.

"It's as if you had three appliances—a coffee pot, a broiler and a radio—all plugged into a single timer," she said. "The coffee pot might be set to go on at 7 a.m., the broiler at noon and the radio at 6 p.m. If something goes wrong with one of the appliances, the others will continue on their regular schedule. You can re-set the timing mechanism as a whole but not the interval between events."

Dr. Colin S. Pittendrigh of Princeton University has demonstrated that he can change the time that the adult drosophila, the fruit fly, emerges from its pupa case by changing the number of hours the case is exposed to light.

At Washington State University, Dr. Donald S. Farner has shown that the changing length of day

Birds that navigate by the sun must be able to tell the difference between the sun at 10 a.m. and the sun at 2 p.m. to be able to fly a true course.

affects the reproduction and migration behavior of the white-crowned sparrow.

Dr. P. L. Adkisson of Texas A. and M. University has observed that the length of day affects the slowing down of such insects as the pink cotton boll worm.

In other experiments, bats confined in darkened laboratory cages have been found to maintain an activity pattern that repeats the well-defined rhythm every 23 to 23½ hours. They know exactly the early evening hour when the insects they feed on are most abundant.

Navigation and time

An even more striking example of the ability to tell time is seen in the way animals navigate by the sun and stars. Such navigation requires not only a sense of direction, but a sense of time because the sun and stars are in different positions in the sky at different times of day.

A bird sighting on the sun must know the difference between a 10 a.m. sun and a 2 p.m. sun if he is to fly a true course. He must also be able to "correct" for the earth's rotation. It is obvious from migratory habits of birds that they can do this.

In one experiment, a number of birds were placed in a planetarium where the roof was covered with photographs of stars. As the huge mural was slowly rotated, the birds changed the direction of their fluttering and hopping. They were orienting themselves to the star patterns.

Experiments have also been made with honeybees to prove the relationship between biological clocks and navigation. In one unique test, bees trained in New York to fly south of their hive for a noon feeding were transported one day by jet plane to California. The purpose: to see in what direction the bees would fly when it was noon in New York. In California, it would be three hours earlier and the sun would be in a different position.

As might be expected, the transplanted bees, their circadian rhythm clocks still running on New York time, left their hives at 9 a.m., Pacific Standard Time, took a bearing on the sun and headed in the direction they thought was south. But it was more to the east and it took the bees about a week to overcome their confusion.

Circadian rhythms can also be found in human beings. This should not be surprising for we are as closely bound by the 24-hour day-and-night cycle as any animal or plant. There is within the human body a regular waxing and waning

One big controversy is whether the biological clock rhythms are controlled by fluctuations outside the body or are entirely self-contained within the body.

of the sugar content of the blood, body temperature, endocrine gland activity, urine secretion and other physiological variables. High points usually come during the daylight hours.

One major area of disagreement among scientists studying biological clocks is whether circadian rhythms are "exogenous" (caused by physical fluctuations outside the organism) or "endogenous" (self-contained and autonomous within the organism).

Many scientists favor the endogenous or self-contained theory. One reason is the fact that plants and animals retain their circadian rhythm even when isolated from their natural environment. A second reason is that biological clocks are apparently impervious to outside changes in temperature. In an experiment conducted near the North Pole several men were isolated in a cabin. To confuse their sense of time, their watches and time pieces were set to run fast or slow. Thus they worked, ate and slept erratically in days that sometimes were 22 hours, sometimes 28 hours long. Despite this upsetting schedule no changes were found in their circadian rhythm.

In 1961, Dr. Hamner provided further proof of the endogenous theory with experiments at the South pole. Assisted by a team of UCLA botanists, he sought to discover whether biological clocks were affected in any way by physical changes in air pressure, temperature, gravity, cosmic rays or ionized air caused by the earth's rotation.

The South Pole was chosen because it represents a single point on earth where these factors are not variable. In addition, if an object were placed on a turntable and rotated counter to the earth's spin once every 24 hours, it would literally be standing still, not rotating with the earth.

This is exactly what Dr. Hamner did in studying such phenomena as the leaf movements of soy bean plants, fruit fly emergence, growth bands on fungus and activity patterns of hamsters. The plants and animals were placed on turntables. Some were spun backwards every 24 hours, others were spun forward, some remained stationary. All experimental subjects were kept in total darkness throughout the experiments.

"After two months of testing," said Dr. Hamner, "it was found that circadian rhythms were not affected by the erratic rotations. The biological clocks were ticking normally in every case."

In spite of such evidence, the exogenous theory (outside influ-

ences) cannot be ruled out at this early stage of research on biological clocks and it is evident that there are many important, even fundamental questions still to be answered.

For example: Where is the clock mechanism located and how does it work? Do the clocks work by physical or chemical means? Is it contained in every living cell, or in key cells located in different parts of the body?

Dr. Janet Harker of Cambridge University has found a biological clock consisting of four specialized cells in a large nerve ganglion just under the esophagus of the American cockroach. Within this ganglion, a special hormone is secreted that causes the roach to follow a 12-hours on, 12-hours off routine of running around all night and sleeping all day.

Further knowledge of biological clocks and what makes them tick undoubtedly will lead to a better understanding of the fundamental processes of life. Four areas have been pinpointed:

1. Commercial flower growers are already using knowledge of photo-

Why jet travel makes you tired

Long flights in today's 600-mile-per-hour jet airplanes frequently produce strange problems of fatigue. Even at the end of a four or five hour flight, the passenger feels a disturbing weariness—especially if he is on an east-west or west-east flight.

Scientists say this condition is caused by man's biological clock getting out of phase, and it takes several days to readjust itself.

The cause is not travel, but the changing from one time zone to another—thus upsetting the 24-hour circadian rhythm of the body.

The earth is divided into 24 time zones, one for each hour of the day. In flying from New York to Los Angeles, a passenger changes three time zones in less than five hours. But in flying from New York to Miami, he stays within the same time zone and his circadian rhythm is not affected.

What to do about this problem?

- Military medical men have questioned the wisdom of high-ranking officers' reporting to the Joint Chiefs of Staff as soon as they land after long flights.
- Standard Oil of New Jersey recommends that its executives not schedule important conferences immediately after a long flight.
- In Tokyo, the Imperial Hotel has special accommodations for the readjustments of weary travellers after an air journey across the Pacific.

So—if you feel weary at the end of a long jet flight, don't blame it entirely on the going-away party your friends threw.

periodism to produce bigger crops for special times of the year. Further information may benefit all agriculture.

2. Recent evidence suggests that the aging process is associated with biological clocks that make some people grow old perceptibly faster than others.

3. Certain diseases such as cancer might be better understood. In one experiment, two sets of cockroaches were raised "out of phase" with one another. One group was active in the daytime, another at night. Key cells were then transplanted so that one group received the special hormone 24 hours a day. The tension resulted in cancer and other ill effects.

4. Information about biological clocks may be important for space flight. Some brain specialists are worried that prolonged weightlessness may affect the circadian rhythm, causing severe damage to the brain and nervous system. Engineers may have to create artificial "day" and "night" to keep the astronauts' biological clocks ticking.

Biological clocks—intricate, baffling, full of blind alleys—represent one of the greatest challenges of present-day biology. But scientists working in this field feel that the mysteries will eventually be solved.

The Thirsty Europeans

THERE has been a shift in drinking habits in Europe, and the amount of money spent on both alcoholic and soft drinks is going up. The traditional wine-drinking countries like France and Italy are shifting to spirits and beer, while Britain and Belgium, which used to favor spirits and beer, are turning to wine. Young people are drinking more beer in Holland and less in France and Belgium. In Britain, women are drinking more beer.

Scotch whiskey is now the top drink in Europe and has become a status symbol. It is the young peoples' drink, yet it has been accepted by all age groups and most income groups throughout Europe. In France, it rivals brandy in fashion appeal, although not yet in total consumption. It is gaining popularity in Italy, has challenged beer's position in Belgium, met the challenge of gin in the Netherlands and become a favorite in West Germany. More could be sold in Europe if so much were not being exported to the United States.

Drinking expenditures have risen sharply on the Continent, with a 9 percent rise in Italy last year. In Britain, the amount spent on alcoholic beverages was up by 6.1 percent in 1962. In France in 1962, 88 percent more was spent on alcoholic beverages than in 1956, and in the Netherlands, beer consumption for 1962 was about three times as much as in 1950.

Soft drinks are becoming especially popular among younger people. Fruit juices and lemonades sell especially well. In France, soft-drink consumption has increased between 1950 and 1962 from 30,000 hectolitres (hundred litres) to 742,000 hectolitres. The trend is spreading elsewhere in Europe.

Know your fibers and fabrics

"Dacron" polyester fibers in rope-like form are heading for the drawing machine where they will be stretched to proper strength.

by John and Molly Daugherty

STRETCH is the biggest news in men's clothes since the zipper. And there's always something new for women. This fall, there's a velvet-ribbon tweed. Half-inch ribbon velvet is threaded in the warp through a slub of mixed colors in the weft for cloth of medieval finery. The *weft* is the *woof*, in case you're wondering! What else do you know about fibers and fabrics?

1. Which one of these textiles gets its name from a material associated with another industry?
   a. Hopsacking
   b. Khaki
   c. Kenaf

2. Which one of these fibers is made from peanuts?
   a. Perlon
   b. Ardil
   c. Ramie

3. From which of the following does angora come?
   a. Goats
   b. Sheep
   c. Albatrosses

4. Which one of these is a natural dyestuff?
   a. Logwood
   b. Mordant
   c. Sisal

5. Which one of the following textile materials is made from seaweed?
   a. Acetate
   b. Acrylic fiber
   c. Alginate rayon

6. Which of these wools has the finest fibers?
   a. Kemp
   b. Shetland
   c. Vicuna

7. Which of the following is a type of quilting?
   a. Tram
   b. Tricot
   c. Trapunto

8. Which one of these is sometimes woven double, face to face, and then cut apart while still on the loom?
   a. Velour
   b. Velvet
   c. Velveteen

9. Which one of these new man-made fibers may be used to carpet kitchens and bathrooms?
   a. Anilan
   b. Olefin
   c. Azlon

10. Which one of these straws, which may be woven, plaited, or braided, comes from wheat?
    a. Toquilla
    b. Baku
    c. Leghorn

Answers:

1 - a Hopsacking. Hopsacking is a weave similar to that used for bags in gathering hops. It's an open basket weave of ply yarn. Khaki, an East Indian word, means earth color. Kenaf, from India and Africa, is a vegetable fiber similar to jute. It's a cordage material.

2 - b Ardil. Ardil is a type of protein fiber manufactured in England from peanuts. Perlon is a synthetic product like nylon. It is made in Germany. Ramie is a fiber quite like flax obtained from the stalk of a plant found especially in the United States, Japan and China.

3 - a Goats. Angora is goat hair from the Angora goat. The fibers are long, white and fleecy. Some angora, however, comes from the hair of Angora rabbits, but must be so described for sale. Albatross is a soft lightweight fabric with a fleecy surface, which is napped. The name comes from the finish it has, which looks like down on the breast of an albatross.

4 - a Logwood. Logwood is one of the natural dyestuffs, although the name is used for a reddish brown color, too. A mordant refers to chemicals which are needed with some dyes to make the dye cling to the textile. Sisal is a hard fiber, much stiffer than flax fiber.

5 - c Alginate rayon. The fibers of this rayon are produced from alginic acid, which is made from certain seaweeds. There are many types of rayon made from regenerated cellulose by two principal processes and sold with various trade names. Since 1952 the Federal Trade Commission has had cellulose acetate products listed as distinct from rayon. Acrylic fibers are made from certain thermoplastic resins.

6 - c Vicuna. This fiber is the finest which is classified as wool. It comes from the small vicuna animal found in the high Andes of South

America. Kemp consists of coarse wavy wool used for carpet fibers. Shetland wool is lightweight and makes warm garments.

7 - c Trapunto. In this process the design is made with single stitches and then padding is filled in from the back. Each part of the design is filled separately. A high relief effect is achieved. Tricot is a knitted fabric, the name of which comes from the French. Tram is a two-ply type of silk filling yarn.

8 - b Velvet. Velvet is usually made of silk or synthetic pile and a cotton back, but it may be all silk or all cotton. According to established rules, if the pile is over one-eighth of an inch, the material is called plush instead of velvet. Velour is smooth with a short thick pile. Velveteen with its filling pile is made to look like velvet, which has a warp pile.

9 - b Olefin. This is a new fiber made from petroleum which is spun as a continuous filament. Its properties are amazing. Carpeting made from it resists shedding, piling, soiling, heavy pressure, moisture and mildew. A truck can drive over it and leave scarcely a trace! Anilan is a Japanese synthetic fiber, like nylon. Azlon is the general name for fibers made from protein sources like soybeans, corn and milk.

10 - c Leghorn. Leghorn comes from wheat in Tuscany. The wheat is cut green and then bleached. Baku comes from the buri palm found in Ceylon and the Malabar coast. Toquilla comes from jippi-jappa leaves and is used to make Panama hats. Incidentally, Panama hats are made in Ecuador!

Score yourself:

9 - 10 right—Your knowledge is "all wool and a yard wide."

4 - 8 right—Better spin a yarn about what you know!

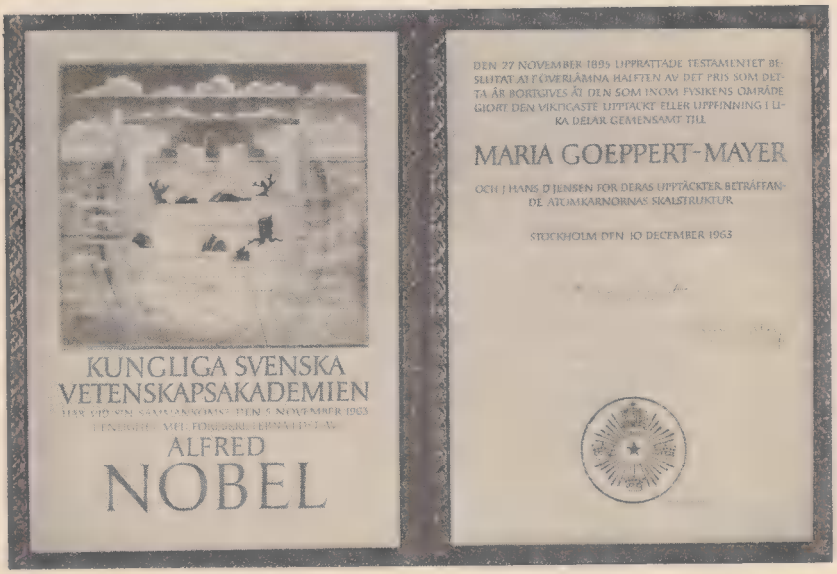
0 - 3 right—At least you know you can't get down off an elephant—or can you?

Rain-making rockets — boon and menace

AIRCRAFT FLYING over South Africa and Rhodesia are in danger of colliding with rain-making rockets (see *Science Digest*, May 1963). In Rhodesia, rain-making rockets are launched so frequently that the government has urged farmers not to use them when planes are in the vicinity.

Owners of a citrus fruit estate in Muden, on the Johannesburg-Durban route of South African Airways, have suffered losses as a result of hailstorm damage to their crops. To turn the hail into rain or soften it, the owners have been launching rockets 6,000 feet into the clouds from eight launching pads on the estate. They are able to put up fifty rockets at once. Damage has decreased since experiments with rain-rockets began.

The secrecy behind the NOBEL PRIZES


KUNGLIGA SVENSKA
VETENSKAPSAKADEMIEN
ALFRED
NOBEL
DEN 27 NOVEMBER 1895 UPPRÄTTADE TESTAMENTET BESTÄMMER ATT FÖRVÄRVSMA HALFTEN AV DET PRIS SOM DETTA ÅR BORTGIVES ÅT DEN SOM INOM FYSIKENS OMRÅDE GJORT DEN VIKTIGASTE UPPTÄCKT ELLER UPPFINNING I LIKA DELAR GEMENSAMT TILL
MARIA GOEPPERT-MAYER
OCH J HANS D JENSEN FÖR DERAS UPPTÄCKTER BETRÄFFANDE ATOMKÄRNORNAS SKALSTRUKTUR
STOCKHOLM DEN 10 DECEMBER 1963

by Fradley H. Garner

ONE autumn morning a scientist was relaxing at the breakfast table over a final cup of coffee when his wife glanced up from her newspaper and asked him whether he knew who had won the Nobel Prize in physiology and medicine.

"No, who?" he asked.

"You," she said.

Whether the man recovered in time to go to Stockholm and collect the Prize on December 10 the story

Photo by Milt Liebman, courtesy of Medical World News

The Caroline Institute above is one of the four bodies that select Nobel Prize Winners. Below left is Nobel physics diploma received in 1963 by Maria Goeppert-Mayer.

doesn't say. Who he was isn't mentioned, either. But the point is clear:

Nobody but nobody—except the deciding bodies who approve the nominations — knows who will win the world's five most coveted annual awards in science and letters, and until the final vote is counted even they don't know for sure.

"Advance disclosures, from a source however well informed, might be deceptive," explains Nils K. Staahle, executive director of the Nobel Foundation, since "even a unanimous committee recommendation is nothing more than a proposal, and on occasions these have not been followed by the deciding bodies."

He cautions: "Any rumor, any informed guess previous to the final decision by the adjudicating prize institution itself should therefore be taken by a candidate at its face value. Only when he gets official notification can he feel sure of his ground."

One can almost see the troubled, bearded visage break into a thin smile at these words. In 1895, a year before he died in San Remo, Italy, Alfred Bernhard Nobel had entrusted execution of his last will to the then United Kingdom of Sweden and Norway.

He did this, the dynamite inventor confided to friends, because he had found more honest people in his native land than anywhere else (an expatriate, he lived most of his life abroad).

Nobel felt, therefore, that his last wishes would be respected most fairly in Scandinavia.

In a marvellously taut, if legally naive, document of less than 300 words Nobel ordered the lion's share of his enormous estate invested in a trust.

This amounted to more than 31 million Swedish kroner—about $31.5 million in terms of today's buying power.

Income from the capital to be invested in "safe securities" by the Nobel Foundation was allocated in equal parts to the five awards: in the fields of physics, chemistry, "physiology or medicine," literature, and "fraternity among nations."

The United States holds the record number of Nobel awards. We have received 18 prizes in physics, 17 in medicine or physiology, and 17 for promoting "fraternity among nations."

"It is my express wish," the will concluded, "that in awarding the prizes no consideration whatever shall be given to the nationality of the candidates, so that the most worthy shall receive the prize, whether he be a Scandinavian or not."

On the receiving end, of course, many countries have kept eager track of their Nobel Prize tallies. The United States, with 64, holds the record, and we have more laureates in physics (18), medicine or physiology (17) and peace (12), than any other country.

Foundation director Staahle finds it "natural that one of the prizes was for chemistry—his (Nobel's) own research had, after all, been chiefly devoted to problems of chemical technology.

"As a corollary science, physics —in which he also had been personally active—would logically be included."

Nobel had experimented in several medical fields as well. Some of his ideas, endorsed by medical leaders of the time, later brought his prizes to others who developed them. This keen interest seemingly prompted him to establish one award "within the domain of physiology or medicine."

There was very little, it seems, that this immensely gifted man did not try his hand at. A voracious reader, he also composed prose and poetry in several languages.

Hence his decision to boost the cause of letters with a yearly tribute "to the person who shall have produced in the field of literature the most outstanding work of an idealistic tendency."

The final adjective here gives a clue to the motive behind the last of the five awards—"to the person who shall have done the most or the best work to promote fraternity between nations, for the abolition or reduction of standing armies and for the holding and promotion of peace congresses."

For the "dynamite king" was a genuine nineteenth-century idealist. And if we can believe what was written by and about him, he abhorred wars as much as he did personal bickering.

More than 90 percent of his fortune was amassed from purely civilian exploitations (mining, road building, tunnel blasting) of his inventions in the field of explosives. He looked upon these as primarily a force for peace. "My factories," he once wrote, "may well put an end to wars sooner than your congresses."

When Nobel's will was opened

in January, 1897, several countries where he had established residence demanded jurisdiction over the estate. A phalanx of outraged heirs contested it. Swedish political leaders from left to right criticized it. Even the King had his doubts. In 1897 a Stockholm newspaper cried:

"When we realize what a harmful effect the right to distribute such large sums of money is bound to have on the institutions that exercise it, one can easily imagine to what intrigues and influences these bodies are going to be subjected.... Every true Swedish patriot would prefer to see the Nobel fortune sunk to the bottom of the sea."

Estate settled

These fears were allayed by the course of events. Sweden won jurisdiction. Thanks to two determined executors the estate was settled in 1901 pretty much as Nobel wanted it settled. The four deciding bodies —The Royal Swedish Academy of Science, for physics and chemistry; the Royal Caroline Medico-Surgical Institute, for physiology or medicine; the Swedish Academy, for literature, and the five-man Nobel Committee of the Norwegian Storting (Parliament), for peace—took on, however reluctantly, and discharged their appointed tasks in a manner that surely would have pleased Nobel.

In the case of the largest and most respected of Sweden's five medical schools, awarding the prize in medicine or physiology

Alfred Nobel, dynamite king, was founder of annual awards bearing his name.

"very considerably and directly stimulated (our) scientific work," according to Professor Emeritus Goren Liljestrand, permanent secretary of the institute's Nobel Committee from 1927 through 1960.

All 48 Caroline professors have benefitted from the close contact with leading scientists everywhere, the 78-year-old pharmacologist points out. The institute has won world renown as a leading research center.

Who nominates Nobel candidates? Who screens and taps them for this honor? Are there any weaknesses in the system? What's the timetable? The procedure is basically the same in all five prize fields. Let's take the one in physiology and medicine and go as far behind the scenes as Prof. Liljestrand, Mr. Staahle and other sources enable us to go.

This year's award, like those before it back to the year 1901, is

In a recent year, some 1,000 authorities in 20 countries were asked to send in works for consideration. Today, prizes exceed $50,000 each, and their value is rising each year.

the presumably happy consummation of a brain-racking, soul-searching, paper-perusing, nine-month process of whittling down.

The mill from which the names of the 1964 winners probably will pop this month began to turn a year ago September, the month that the advisory medical committee appointed by the Caroline Nobel Institute annually sends out invitations to propose candidates for the next year's award.

Entries judged

Caroline Professors U. S. von Euler, Hugo Theorell, a Nobel laureate, and Stan Friberg are permanent members of this five-man panel, and experts may be appointed to help judge the entries.

Certain people are permanently entitled to nominate: Nobel laureates in the field, the Caroline professors, members of the medical section of the Royal Swedish Academy of Science, and the medical faculties of the Universities of Uppsala, Lund, Oslo, Copenhagen and Helsinki. In addition, the committee can issue confidential invitations to other qualified persons anywhere in the world. In one recent year some 1,000 authorities in 20 countries allegedly were asked to send in works for consideration.

"Anyone proposing himself for a Nobel Prize is by that fact ruled out of consideration," says Staahle. This happens from time to time, too. He also notes that "only *individuals* belonging to these bodies . . . not the organizations as such," have the right to propose, though several members may join in a single proposal.

He adds that "Since the Swedish or Norwegian authorities have no influence whatsoever on the prize decisions, any official representations or support in favor of a certain candidate—whether diplomatic or otherwise—is of no avail."

Though it leans over backward to avoid abuses, this system does have a few cricks in its statutes. The regulations state that one prize cannot be divided more than three ways. In light of the current "team" approach to research, this was bound to cause embarrassment. Last year Dr. Bernard Katz, third man in the Cambridge, England, group of Alan L. Hodgkin and Andrew F. Huxley did not share in the prize. Australia's Sir John C. Eccles was the co-winner.

Still more regrettable, Nobel officers acknowledge, is the plight of the eligible but unsung coworker who never gets proposed.

Any changes in the nominating or award-sharing procedure must be voted by the prize-awarding institution, the Nobel Foundation trustees and the Crown.

January 31 is the deadline for filing nominations, and when the medical committee buckles down to its task behind closed doors next day there are somewhere around 100 names in the bin. Last year, according to a reliable though non-official source, there were 70. A memorandum on each nominee and his sponsors is sent to the Caroline Institute.

By March the critical two-part screening is well underway. New works as a rule are first referred to outside experts who evaluate them on the basis of the literature and their own knowledge. (Prof. Liljestrand says it was once thought that specialists working in special laboratories could experimentally test the nominees' work. But in the brief time available and with the limited facilities at hand this obviously proved impractical.)

About a month later the committee sends its recommendations to the institute. At their first scheduled meeting in May the 48 professors review and discuss them. They are free to add other names. As a rule about 10 to 20 candidates (15 last year) are still in the running. During the summer months the experts prepare "depth" reports of up to 35 pages, detailing the crucial points of each discovery.

Here, Prof. Liljestrand reminds us, lies a common misunderstanding. For the prize is not given for a man's or woman's general achievements but, as specified in Nobel's will, "to those who, during the preceding year, shall have conferred the greatest benefit on mankind." That is, the contribution must be specific.

Prize for penicillin

That "preceding year" clause, however, tends to be treated as though there were an "s" after it. The retired committee secretary cites Alexander Fleming as a case in point.

Though Sir Alexander discovered the penicillium mold on a culture plate in 1928, and kept it alive for years mainly as a curiosity, a prize "for the discovery of penicillin and its curative effects in various infectious diseases"—awarded in 1945 jointly to Fleming, Ernst Chain and Sir Howard Florey—had to await establishment of the original antibiotic's clinical value more than a decade later.

A more recent example: Last year's winners, Drs. Hodgkin, Huxley and Eccles, produced their masterwork—a detailed description of the intimate nature of nerve impulses — within or before the last decade. The situation is often the same in physics, chemistry and the other prize fields.

By September the reports have been deposited with the committee, which makes its final recommendations to the institute before the month is out. If the five selectors

Nobel gold medals, diplomas and prize checks are presented simultaneously in Stockholm and Oslo by the Swedish and Norwegian kings on December 10, the day of Nobel's death in 1896.

have agreed on one or a group of candidates, chances are the professors will second the choices. If there is a difference of opinion, there may be some crackling dialogue behind the closed doors.

"Speculation in the press everywhere regarding the outcome increases as the time for decision draws near," says Nobel Director Staahle. "Nothing is revealed to the public, however, before the final decisions are made during October or November.

"And even then only the decision with a short citation is immediately published (except in the case of the Peace Prize, where no motivation is given). The deliberations as well as the votes are secret."

Winners cabled

Until four years ago the announcements were made in late afternoon, Stockholm time. Cables to winners elsewhere in the world often did not arrive at their laboratories until late evening—which meant that many learned about it via telephone calls from reporters or friends or, like the scientist at the breakfast table, from the morning newspapers. Since 1960, however, the news has been broken earlier in Stockholm, and the telegrams timed to arrive during working hours.

Prof. Liljestrand, who studied and taught at the Caroline Institute for more than a half century, also remembers a time when the Nobel winners were informed in October, but their names were not made public until the award ceremony in December. What a strain this put on the scientists and writers and peace architects who had to stay mum for two months, we can only guess.

Some did not fare so well. No sooner had he read the opening sentence of the telegram than the second (1902) winner of the medicine prize, Ronald Ross of Great Britain, blurted out the news to colleagues standing around. Then he read the sentence requesting secrecy.

British chemist Ernest Rutherford, who won the 1908 chemistry prize for his radioactivity investigations, wrote a "guarded" letter to a German friend in November: "I may tell you in strict confidence that my wife and I are going to Stockholm on December 10. We shall probably return via Berlin for the express purpose of seeing you. Do not say anything about this until after the proper date."

The coronation of these efforts

always takes place on December 10, the day of Nobel's death in 1896. In white tie and tails ceremonies in Stockholm's Concert Hall and simultaneously in Oslo, the Nobel gold medals, diplomas and the prize checks are presented by the Swedish and Norwegian kings.

A speech is part of the pomp, and later the new laureates are guests of honor at a ball in Stockholm's Town Hall.

Value of prizes doubled

Mr. Staahle recalls that the first prizes in 1901 at today's exchange rates amounted to about $30,000 each. Now the prizes have passed the $50,000 mark and tend, for the time being, to keep pace with the waning value of money.

But he says that each prize "today represents only about a third of its original 'real' value. In 1946, the Foundation was exempted from taxation on its property as well as on revenue from it, with the exception of the local real estate tax. The prize money, so far as is known, has been exempted from income tax in the country of the recipient either *de lege* or *de facto*."

However, as one observer put it, the cash is generally looked upon as "mere frosting on the large cake of Nobel Prize honor." The scientific and public status of the Nobelist is changed forever. His opinion on almost any subject will be heeded. He will find it easier to get grants for research. Students will vie to work under him. He will have worldwide respect.

The Nobel prize is a call to Mount Olympus.

Johnson's and Goldwater's Health

How healthy are the Democratic and Republican presidential candidates? Their doctors report that President Johnson and Senator Goldwater are in excellent health, although Johnson suffered a heart attack nine years ago, and Goldwater had two breakdowns from exhaustion twenty-odd years ago. As a result of the heart attack, Johnson stopped smoking, lost thirty pounds and observes a strict diet. Because of the regimen L.B.J. follows, his chances of fulfilling a normal life expectancy are considered above average. His demanding schedule and less than six hours of sleep a night are the only causes of dismay to his doctors. Senator Goldwater has had no serious illness in recent years. His much publicized nervous breakdowns have been dismissed by the men around Goldwater as simple cases of exhaustion resulting from long, hard work. A United States Air Force medical report states that the Senator has had no mental or nervous disability in the last 22 years. In addition to the duties of public office, Senator Goldwater flies jets, rides horses and enjoys active outdoor recreation. The contenders for the high office appear to be physically in shape for the job they seek.

When you must 'ditch' at sea

Ditching at sea is a rare but real risk of the overseas air traveler. Here is what the Coast Guard is doing to increase chances of surviving this terrifying experience when it happens.

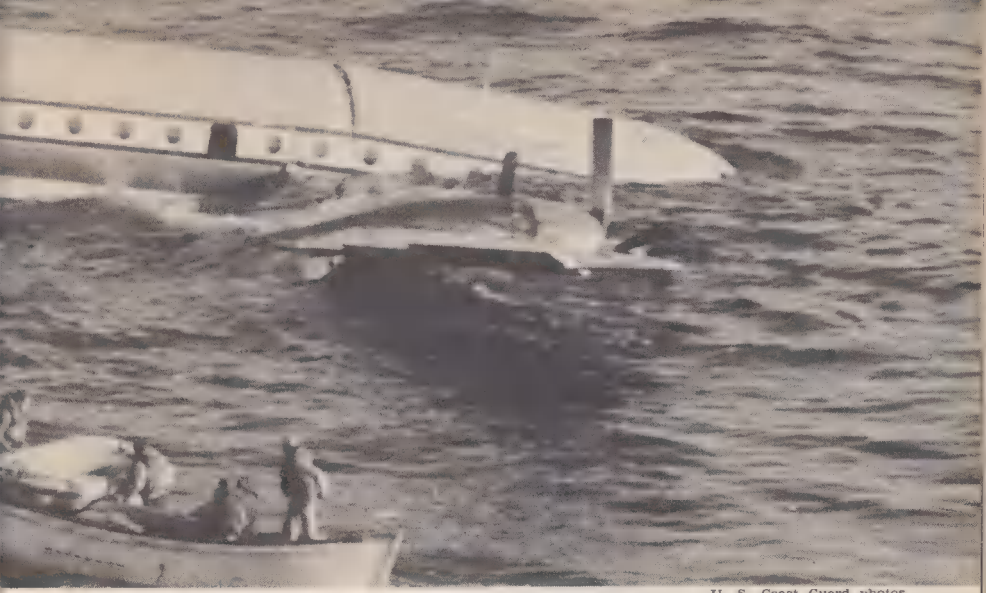
by E. John Long

ALTHOUGH fortunately it does not happen very often, thanks to careful maintenance ashore and careful navigation en route, the "ditching" of a plane at sea must be faced as one of the grim possibilities of overseas air travel. And, as the number of trans-ocean air flights, both scheduled and non-scheduled, increases steadily each year, it is unavoidable that the number of ditchings will increase, too.

All things considered, the chances of survival are good for those forced down at sea, even though disasters seldom happen twice in just the same way. "Search and Rescue" (SAR) is not a haphazard matter but a well organized program, using men trained and equipped for a special job.

Foremost, of course, among those who must bear the burden of air-sea search and rescue, and of or-

Reprinted with permission from *Sea Frontiers*.



U. S. Coast Guard photos

Twenty minutes after this airliner "ditched," her passengers and crew were rescued by the U.S. Coast Guard. New equipment will make such successful rescues easier.

ganizing assistance to ships and other planes within a distress area, is the U.S. Coast Guard. Its big cutters are now positioned across the busy North Atlantic and mid-Pacific sea and air lanes, and its amphibious planes and helicopters are constantly on patrol nearer inland.

Even far beyond the U.S. three-mile limit the Coast Guard must be prepared for any emergency. To assure the safety of trans-oceanic ships and planes, four U.S.C.G. mobile ocean stations are now maintained in the Atlantic and two in the Pacific throughout the year. In most instances where a plane must ditch at sea, the pilot has had some warning of trouble far enough in advance to enable him to send out distress calls and to prepare the passengers and crew. If the pilot is very lucky, he may have enough time to work the plane down steadily to a rendezvous with a cutter, or with other vessels known to be nearby. If ditching must occur at night (doubly hazardous), the presence of a Coast Guard cutter is a blessing, for it can direct the plane into the best wind and wave path by throwing out small battery-powered floating bulbs.

Survivors, of course, must scramble for themselves through the hatches when the plane settles on the surface. Crew members, by this time, have rafts and rubber boats inflated and, if survivors are really lucky, they may be able to hop from the wings of the plane to the rafts without getting wet. But there is not much time. Usually no more than twenty or thirty minutes elapse (and often much less) before a ditched plane goes under. Most survivors must depend on their life jackets, which they are warned not to inflate before they

In a practice session, volunteer "survivor" marks his position with a smoke flare. At night, a bright flare would be used.

leave the hatches—lest they be blocked inside, like corks inside a bottle. The only recourse then would be to ditch the jacket too—a risky venture in a choppy sea.

Hazardous and frightening as ditching and emergence from the plane are, the most difficult phase of the entire operation comes when the survivors are brought alongside a rescue craft. The bumping, bobbing surfboats and the big inflated rubber rafts make it difficult to transfer survivors to the rolling deck of a cutter, even in a moderate sea. If the waves are rough, and the survivors are injured, seasick or in a state of shock, as most of them may be, the cutter crew is in double-trouble. No one feels really safe until he is on board the cutter, yet it may be necessary to transfer 100 or more people—a tricky, time-consuming task.

The Coast Guard has been earnestly working out new techniques for this particular aspect of air-sea rescue. In the open Atlantic off Bermuda, simulated ditching missions were given a rigorous trial run. The wind was blowing a steady 25 knots, with gusts 30 and above, and waves ran nine to ten feet high giving stark realism to the test. The experiment was conducted by the crack rescue crew of the big cutter U.S.C.G. BIBB, a veteran of several actual plane ditchings and ship sinkings.

With white water coming over the bow, the 327-foot cutter slowed its engines and swung broadside to the wind to permit the rescue team to push off and swing around to leeward. A motorized surfboat first towed a 25-man inflated life raft alongside the cutter. This raft is the customary means of transfer from a stricken plane or ship to the cutter. But it is cumbersome and difficult.

Floating platforms

Next one of the new 10-by-15-foot plastic mats or floating platforms was employed. It clung close to the water line, yet was so buoyant that several people could stand or lie on it without its capsizing or crumpling. It worked very well with a limited number of survivors, but it was obvious that faster action would be needed to hoist persons who were sick or injured.

However, there can be no question that it was easier to remove a survivor from the new platform than from the inflated rubber raft or the motorized surfboat. No one was pitched between the raft and the cutter, and the new mat offered a broad area from which to handle survivors by means of slings and high speed hoists. In fact, a few able-bodied persons might be able to climb alone from the mat up the cutter's boarding ladder.

Buoyant plastic litter

In addition to the familiar Erickson wire basket, long used to lift survivors from water to deck, the Coast Guard now has a plastic litter, which is smaller and form-fitting. Its principal advantage is that it is buoyant, thereby avoiding dunking the survivors.

One of the other rescue devices did not satisfy minimum standards. This was the so-called "chemiluminescence," a revolutionary luminous marker designed to provide better illumination in the wave path of aircraft forced to ditch at night. The substance is packed in two-by-two-foot squares, covered with floating transparent plastic bags. The flameless luminescence is set off by mixing water with the bags before they go overboard.

An airplane from the Bermuda air detachment came out to check the effectiveness of the new marker. But, alas, the illumination was not as strong as that of the battery-powered floating bulbs, now used

Inflated plastic mat supports four men without collapsing and is flexible. Such a device is superior to a rubber raft for rescue purposes because it becomes, in effect, part of the water and is easier to board and leave.

Sick and injured can be brought aboard easily in a new foam plastic litter. Unlike conventional slings, it doesn't dunk its occupant while sailors prepare to hoist it.

to mark ditch paths. Nor did the luminescence achieve pilot depth perception as expected.

Few persons realize that Search and Rescue is the Coast Guard's primary mission. Any Coast Guard vessel on any other mission can be diverted to help a ship or aircraft in distress. In 1962, the Coast Guard saved 2,597 persons and answered 35,848 calls for assistance, involving a total property value of 1.5 billion dollars—more than four times its budget for the entire year.

SAR (Search and Rescue) is comparatively new in the air-sea rescue business, but it carries on the fine old traditions of the Lifesaving Service, which Congress first authorized in 1847 for boathouses and surfboats then close to the coast. The Lifesaving Service was amalgamated with the Coast Guard in 1915.

These policemen of our marine security seem to be always on hand when disaster threatens, and usually they come back with survivors. They cruise some 3,000,000 miles a year, from the frigid north to the torrid tropic seas.

What is the formula for success against unexpected disaster? SAR takes the viewpoint that disasters must be expected at all times—so they select good men, train and equip them well, establish general criteria, and then let them use their own judgment in the saving of lives and property.

RADIATION exposure makes male rats produce less intelligent offspring, according to Dr. Harold B. Newcombe of Atomic Energy of Canada, Ltd., Chalk River, Ont. The male rats' reproductive organs were exposed to X-rays in an experiment. It was found that their descendants' learning impairment compared to a decline in human intelligence of 5.3 I.Q. points.

The Hugh Downs Column

THE FUTURE OF MAN

Unknown vistas loom when we imagine the changes possible if man "programs" genes.

WHATEVER our animal ancestors looked like in the mists of the early dawn of the Age of Mammals, we know they were there. And we can say with reasonable certainty (and in spite of gloomy speculation about our annihilating ourselves with the lethal residues of our technology) that our descendants will inhabit this and possibly other planets thousands of years hence. What will they look like?

Two hypotheses underlie most science fiction dealing with the far future: (1) that we will look pretty much the same from here on as we do now; (2) that we will have "regressed" along predictable lines to a repulsive physical puniness.

The first of these hypotheses appears to be based on the assumption that physical evolution has been brought to an effective standstill by the development of the mind. There is some logic in this. Survival of the fittest no longer leads to organic specialization in the way it did before an animal came on the scene to substitute sharpened bronze and iron for teeth, to grind lenses for strengthening and magnifying eyesight — an animal that disdained spending hundreds of thousands of generations developing feathered or membranous wings, but in a single generation put a gasoline engine on a kite and flew.

There is no advantage now in changing physically except possibly to rid ourselves of troublesome vestiges of our early animal existence, such as tonsils and wisdom

Tomorrow we may have temperature-controlled underclothes, infra-red eyeglasses, and all-distance audio-sending aids.

teeth, appendices and spinal weaknesses brought on by the unnaturalness of an upright stance. But even these problems are being met technically through surgery and prosthetics, and it seems unlikely that man would wait for Natural Selection to accomplish something he can deal with more immediately by thinking.

The second hypothesis is equally valid, however.

It says we will change, but in the direction of physical weakness. And since it points out that this process started a long time ago, it can offer evidence in support of its claims:

When other animals, faced with increasing cold in the ice ages, grew shaggier coats of body hair, Man killed and skinned them and made coats of their shagginess. Thus clothing was born. This eliminated the need for most body hairs and Man became a relatively bare-skinned animal. There are anthropologists who believe that human hairlessness, particularly in females, had its origin in esthetic considerations. This idea, without clarification seems naive since esthetic ideals are conventional and not intrinsic and as sound a case could be made for baldness as a feature of female attractiveness. (In spite of recent Parisian fashion convulsions promoting smooth-pated girls, I can't personally imagine living long enough to get conditioned to lusting after a female Yul Brynner.)

Cooking food made both chewing and digesting easier with resultant diminution of jaw strength and increased vulnerability to the condition of subsisting on raw meat.

Devising mechanical aids, such as the lever and eventually modern industrial power, has further weakened the muscular strength of man and made us already puny compared to other animals of like size.

Is this an "unhealthy" situation for the future of civilization? Technology recruited in the cause of progressive human ease might appear to undermine our health. Power steering and brakes, electrically driven typewriters and toothbrushes, powered saws, drills and screwdrivers — the whole pushbutton way of life removes some of the exercise opportunities necessary to muscle tone and it is doubtful that health clubs and increased leisure make up for the loss. (Most golf courses offer powered carts now.) However, health is a relationship between an organism and its environment, and though man might be weaker than his ancestors from a muscular standpoint, he has more power at his command and his life

expectancy is at an all-time high. By the most important standards, man is a very healthy, very tough form of life. So long as there is increase in our life span, our ability to cope with our environment, and our general well-being, does it matter whether or in what way our physical appearance changes?

Hypothesis No. 2 allows some interesting speculation as to how we might look in several thousand years, assuming the mind remains in control and human affairs avoid major setbacks. Increased use of artificial protection and sense-amplification devices may tend to encase the human organism in more technical apparel. (Remember this began with clothing and continues with eyeglasses and hearing aids.) Let's carry this to an extreme and picture the human of the future as completely hairless, rather large-domed and weak-limbed, wearing temperature-controlled undercloth-ing, infra-red or extended spectrum eyeglasses, multi-channel all-distance audio-sensing aids, air-purification and breath-control systems. He may possibly even have atrophied lungs and carry oxygen-extraction systems, equally effective in air or water, or oxides for use in outer space. Personal locomotion might be accomplished effortlessly by means of "powered" clothing so that weak muscles need only trigger a relay to amplify the power wishes of the organism.

These are the standard speculations of a generation of science fiction writers — more sophisticated than Jules Verne, but still predicated on the use of technology.

It's quite possible that none of this will come to pass and that human change will take a far more sensational and fantastic form in which technology will play a far less important role.

Some terrifying vistas loom up when we think of work being done in genetics right now. Biochemistry is lurching forward as though a taut leash suddenly gave way.

Imagine the changes possible when man can "program" genes; if social and religious fears are allayed sufficiently to allow the brightest, most stable males to father thousands of children, each through artificial insemination; if selected females, chosen as the matrices of oncoming generations, could be relieved of the risks of full-time pregnancy and delivery by removal of the embryo to an artificial womb.

When emotions are channeled and tailored to the needs of an enlightened civilization; when psychic energy is poured into the fight against human suffering and the total conquest of man's environment; when the mind, bulwarked by computer technology but bred to a high pitch of complexity and efficiency, addresses itself to problems we may even be yet unaware of; when Life, in the form of its advance guard, Man, gains its virtual independence from the physical universe, we may understand things we have glimpsed but foggily in the dreams of our young and the visions of our aged.

SCIENCE

in government

If you've ever been confused about the role of science in our Government, or wanted to know whom to write or call about a particular subject dealing with science or research, there's something you can do. That's pay $1.75 for a copy of the recently published *U.S. Government Organization Manual 1964-65*. It's sold by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Or it may help to know in brief what the book says about science in the Government (besides a host of other facts about the Federal establishment):

Washington has three official or quasi-official scientific bodies. They are the Office of Science and Technology, the National Science Foundation and the National Academy of Sciences — National Research Council.

The Office of Science and Technology is the newest of the lot. It was set up in the Executive Office of the President in 1962. Its purpose is to provide advice and assistance to the President in developing policies, and evaluating and coordinating programs to assure that science and technology are most effectively used in the interests of national security and the general welfare. The director is Donald F. Hornig. The manual doesn't say so, but the Office is rated the most influential science organization in the Government. Its address is Executive Office Building, Washington, D.C. 20506. Phone, EXecutive 3-3111.

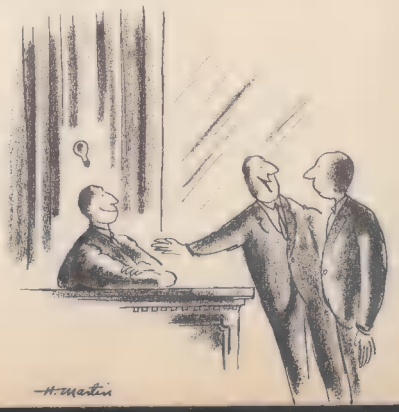
The National Science Foundation was established by Act of Congress in 1950 to strengthen basic research and education in the sciences. Its activities include: 1. The development and dissemination of information about scientific resources. 2. The award of grants and contracts primarily to universities and other nonprofit institutions in support of basic scientific research. 3. The support, through contracts, of national centers where extensive facilities are made available for the use of qualified scientists. 4. A program of research and evaluation in the field of weather modification. 5. The award of graduate fellowships. 6. Programs aimed at improving scientific education. 7. A

program aimed at improving the coordination of the various scientific information activities in the Federal Government. The Foundation's director is Leland J. Haworth, who is assisted by a deputy director and three associate directors, five division directors and six office heads. In addition, there is a National Science Board consisting of 24 members approved by the Senate. The Foundation's address is 1951 Constitution Avenue NW., Washington, D.C. 20550. Phone, 343-1100.

The National Academy of Sciences—National Research Council is a two-part body. The Academy is quasi-official and was established by Congress in 1863 during Abraham Lincoln's first administration. In 1916, President Wilson asked the Academy to organize the National Research Council as a measure of national preparedness. The Council was perpetuated after World War I. The Academy is an organization of distinguished scientists, dedicated to the furtherance of science and its use for the general welfare. The purpose of the Council is to stimulate research in the mathematical, physical and biological sciences and in their application, with the object of increasing knowledge, strengthening the national defense and contributing to the public welfare. The Academy-Council has no laboratories of its own but seeks to stimulate and support the work of individual scientists and to coordinate investigations dealing with broad problems in research—through conferences, committees, surveys, etc. An eleven-member Council of the Academy runs the dual-organization's affairs. About 300 people, drawn from academic, industrial and government organizations, make up the National Research Council. The President of the Academy, the parent body, is Frederick Seitz. Address: 2101 Constitution Avenue NW., Washington, D.C. 20418. Phone EXecutive 3-1800.

So much for the big daddies of science in Washington. For the myriad other offspring of science in the government today, you can check the *U.S. Government Organization Manual* index. You'll find NASA's Jet Propulsion Laboratory and dozen or so other centers (pp. 449-53), the Office of Saline Water (pp. 238-39) and such assorted activities as the Bureau of Entomology and Plant Quarantine (p. 632) and, under Research, everything from Aerial Photography (p. 247) to Women, Employment of (p. 326). — HUBERT PRYOR

"William, here, is our idea man."



"STRIKE IT RICH" with this PROSPECTOR'S PACKET of exotic rocks, minerals and gems

QUARTZ
is the most abundant of all minerals and is found in many rocks. It forms crystals, but this variety comes from veins.

MARBLE
the "perfect medium" for sculpture. When polished, it closely resembles the texture of human skin.

GARNET
is a gem mentioned in the Bible. Crystals are common in the rock called schist, which once was hardened mud.

IRON PYRITE
also known as "fool's gold," because its yellow glitter has deceived many an unwary seeker of gold.

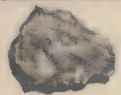
STAUROLITE
is sometimes found in form of cross-shaped double crystals. They are prized as good-luck charms.

ASBESTOS
This fibre-like mineral can be woven into fireproof fabrics. The ancient Greeks used it for wicks of sacred oil lamps.

MAGNETITE
is a rich ore of iron. It can be picked up by a magnet, like iron or steel. Your sample will deflect a compass needle.

FLUORITE
occurs in veins in limestone and several other rocks. Once carved into ornaments, it now is used as a flux in steel-making.

SELENITE
An ancient superstition says that this mineral grows larger and smaller along with the waxing and waning of the moon.



CHRYSOCOLLA
When cut and polished, it is often set in jewelry. Chrysocolla is a copper mineral found in many Western mines.

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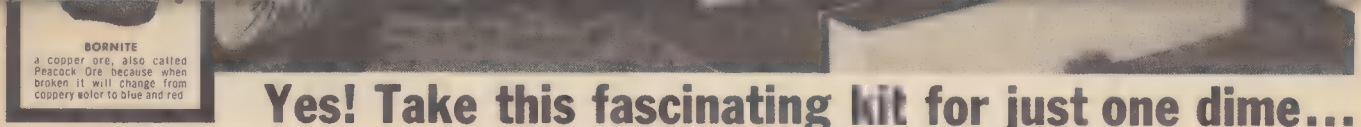
AGATE
first found near Achates river in Sicily, is a semi-precious stone used in jewelry, bowls and vases.



BORNITE
a copper ore, also called Peacock Ore because when broken it will change from coppery color to blue and red

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Coming: Big Space Decision

by Warren Burkett

FIVE years will pass before an American steps out onto the Moon. Yet the President must decide this winter what we will do for an encore.

More than $50 million worth of plans exist now for using the manufacturing plants, the tracking networks and the thousands of new workers in the government and industrial space establishment built up for Apollo. These projects beyond Apollo's Moon landings can occupy our spacemen well into the year 2000.

A large space station 300 miles above Earth competes with a permanent Moon base for the next big slice of federal tax funds. Another contender is Project XMAS using a modified Apollo space ship to fly far beyond the Moon. The title stands for Extended Mission Apollo Spacecraft.

Several leaders in and out of NASA, the space agency, think America can plunge directly into preparing for manned expeditions to Mars, Venus and Jupiter. Some heady thinkers anticipate the possibility of orbiting Saturn and landing on one of its moons by 1997.

Federal planning practices and the time needed to build future space vehicles require a Presidential decision before the next budget message. Some form of space station appears certain. Probably the De-

One possible follow-up to the Apollo project would be a manned Mars expedition. An artist's conception shows an expedition ship in orbit around the planet while space-suited crewmen inspect the landing vehicle before descending for a month's stay. Main ship would remain in orbit.

partment of Defense will dominate it. The Air Force recently swapped its cherished Dynasoar space plane for the first crack at the two-place Manned Orbiting Laboratory (MOL). About 1968, two military astronauts will ride out from Cape Kennedy in a Gemini spacecraft. Their Titan III rocket, with 2.5 million pounds of thrust, also will carry up a laboratory cylinder about 10 feet in diameter and 20 feet long.

Similar versatility exists for the Apollo space ship once we pass critical points on our push to the Moon.

The three-module construction of the Apollo Moon ship permits several variations in its purpose. By switching modules, NASA planners think they could equip Apollo to orbit Earth for 600 days with resupply every 120 days.

Maxime Faget, head of engineering research at MSC, can see many uses for such a convertible Apollo spacecraft. One mission outlined by Faget calls for Apollo crewmen to use the ship's rockets to put the laboratory into a polar synchronous orbit. This brings the entire Earth under weather, scientific and photographic observation.

Enlarged Apollo space ships can ferry six or a dozen men to the laboratory or a larger space station. E. H. Olling, chief of space station research at the Manned Spacecraft Center, says the Apollo used on ferry flights can gain weight and space for men and supplies by using a lighter heat shield. Speeds for reentry are nearly 8,000 miles per hour below the 25,000 miles per hour an Apollo will travel coming back from the Moon. Less speed means less heat must be dissipated.

Medicine to engineering

Variations of the basic Apollo Moon ship can provide the medical and engineering information needed for interplanetary flights or a permanent Moon base. A few men using a tested space ship can thus gather most of the facts about space without the tremendous costs needed to develop space stations for 18-36 men. With proper modules, North American Aviation engineers say, Apollo can orbit around the Moon

A variety of nuclear-powered planetary ships for a fleet expedition to Mars.

for 120 days, or make long, elliptical orbits of 120 days that swing far out from the Earth and come back.

Economics and some reservations about the value of a space station lead many people to prefer a Moon base.

Experts in the space agency estimate that each pound of men and supplies costs $1,000 to put into Earth orbit. It probably will cost $5,000 per pound to put them on the Moon, although the large Saturn rockets should cut these costs more than half. However the Moon promises to supply many of the materials needed for a crew of two or three dozen spacemen.

Jack Green of North American Aviation has given the Moon's resources considerable study. Ancient volcanoes probably left usable materials such as sulphur and pumice. Miniature processing equipment could turn sulphur into waterless cement, bricks, and electrical insulation. Pumice, either raw or processed, affords potential insulation against micrometeorites, heat and cold. You can make roofing materials or walls from it. Volcanic basalt rock can be used for crude pipes and containers or converted into fibers for bedding, clothes, ropes, etc.

Water probably exists as ice frozen beneath the surface or in the perpetual shadows of caves, crags and fissures. Many kinds of Earth rocks trap water molecules in microscopic holes in the rock structure. Solar reflectors and nuclear reactors produce enough heat to break down the rocks and release the water. From water the men on the Moon base can produce oxygen for breathing and the hydrogen-oxygen mixture consumed by a fuel cell generating electricity.

Breaking down the rocks

Many different chemical compounds are possible if the rocks are broken down further into their basic elements. Synthetic foods, like those eaten by NASA subjects at a California prison, might be compounded. Possession of basic chemicals naturally leads spacemen to consider making rocket fuels on the Moon. One of their oldest dreams involves using the Moon as a refuel-

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Warren Burkett is the Space and Science Editor for the *Houston Chronicle*, where he keeps close tabs on the neighboring Manned Spacecraft Center.

Some spacemen dream of using the moon as a base to explore the planets. It's a steadier viewing platform than a space station and it has gravity, a difficult condition to simulate.

ing stop and launching pad for exploration of the planets.

The Moon is a steadier viewing platform than the orbiting space station. The weak gravity of the Moon (one-sixth that on Earth) promises relief from the potential dangers of long-term weightlessness. Some engineers see only nightmares in the problem of producing an artificial gravity by rotating the space station precisely four times per minute.

Five lunar landings are planned near the Moon's equator in Project Apollo. Later the distribution of minerals may dictate the location of a permanent station. So might the location of hot spots or pockets of trapped gases, as indicated by recent observation of glowing red light coming from near the craters Aristarcus and Alphonsus.

Locating a base near one of the poles would mean almost continual sunlight for manufacturing operations and scientific observations.

The Army Corps of Engineers and Manned Spacecraft Center have a dozen plans for assembling the permanent base. These plans call for a step-by-step growth of the station. Activities of the Moon base's residents will be separated as much as possible into cylindrical modules. Each module will be designed for the particular type of work performed inside. Industry estimates of $60,000 an hour for lunar construction mean that every bit of prefabrication possible will be done on the Earth.

The modules will be covered with Moon rock at first to insulate them from micrometeorites, radiation and temperatures that range two hundred degrees above and below zero. Power shovels will be operated by the astronauts or remotely controlled by radio. Prefabricated tunnels will connect the modules. Air locks on the outer doors will hold air pressure inside the station so the men can shuck their space suits. Station personnel will breathe a mixture of nitrogen and oxygen since medical studies now indicate that two weeks is the longest time you can safetly inhale the pure oxygen used in the Apollo space ship.

Space to live and work

Later the Moon base units will be buried in excavations or natural fissures if the Moon's rock and ground structure is solid enough. Other fissures or caves may be sealed with air-tight materials sent from Earth or manufactured on the Moon. Mining and manufacturing will leave excavations suitable for conversion to living and working areas.

Beyond the Moon are the planets.

Enthusiasm for a trip to Mars and Venus runs from NASA's Washington headquarters down to the research and development centers and through more than a score of aerospace firms.

These flights will take months, years even. Oran W. Nicks, director of NASA's lunar and planetary programs, shrugs off these times. "Marco Polo spent 24 years on his round trip from Venice to China. It's also noteworthy that the Dutch successfully colonized the Indies in spite of the fact that it took some four years to voyage there and back by ship," Nicks said recently.

Planetary missions in NASA's books divide into "fly-by's" and "capture" flights.

"Venus fly-by's are the easiest and fastest manned planetary missions. Mars landings are the easiest of all planetary landings," says H. H. Koelle, head of future projects at Marshall Space Flight Center.

Large laboratory module orbiting over the Earth's poles would have many functions.

You can shoot spacemen past Venus in less than eight months or around Mars in less than fifteen.

Dr. G. A. Crocco and Franklin P. Dixon, Philco Corp., have calculated that in 1970-72 the planets will be lined up right for flying by both Mars and Venus in one trip. Time: About 400 days, possibly aboard a converted Apollo.

Lining up the planets

Unfortunately, this time comes in the middle of the Project Apollo Moon landings. Venus and Mars will not reach the proper positions again until the early 1980's. However Krafft A. Ehricke, the grey eagle of German rocket pioneers, thinks fly-by missions will produce little of value, particularly in the neighborhood of Venus with its 600-degree surface temperatures.

A month's stay on the surface of Mars promises more for the post-Apollo dollar, say engineers at the Manned Spacecraft Center. David M. Hammock, head of Mars studies, thinks NASA can do it with chemical rockets and engines used in the Apollo program. Ehricke, now with General Dynamics, wants to wait for a nuclear upper stage on the booster.

Hammock's plan calls for three or four Saturn V launches to place the four-part Mars ship and a load of fuel in Earth orbit. After assembling and fueling the ship, five or six crewmen would fire it on a Mars trajectory.

The Mars ship resembles a large

arrowhead 100 feet long. Its point consists of a command module and reentry section. Back of the point is the Flight Module, roomy enough for sleeping, exercising, working and recreation. Rockets and fuel tanks fill the module at the base of the arrowhead. A two-man landing vehicle rides piggy-back on the main ship.

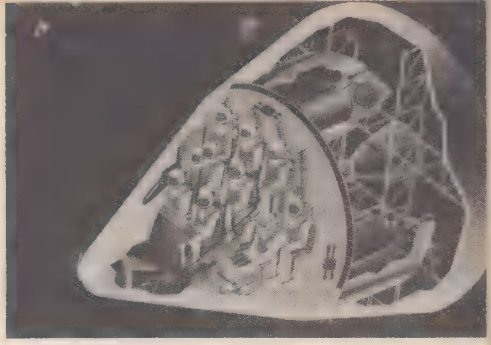
Near Mars, the astronauts would skip their ship into the edge of the atmosphere, slowing down to orbital velocity (about 10,000 miles per hour for Mars). The landing crew drops down to the surface aboard the ferry.

The thin, dry air on Mars simplifies landing; it offers less resistance to the vehicle. Landing also comes more slowly, thanks to the lesser Martian gravity, one-third that of Earth. The Mars ferry needs less heat shielding than the Mercury capsule.

Martian advantages

Astronauts and scientists can explore the Martian surface around their laboratory much easier than on the Moon. Only a light, simple space suit for warmth and oxygen supply will be needed in the Martian atmosphere; conditions probably resemble those at 18,000 feet on Earth. After a month, the crewmen would squeeze into a "rendezvous pod" and blast off to rejoin their comrades in the orbiting mother ship and return home.

Faget has suggested landing on Phobos, largest of the two Martian moons, as an alternate plan. Setting down on airless Phobos, only 3,800 miles from the surface, poses a similar problem to landing on the Moon.



Enlarged Apollo command module with double-deck seating could hold 12 men and be used as a ferry to space stations.

Attempts to reach Jupiter or the asteroids beyond Mars will come long after Project Apollo. However an occasional asteroid passes within three million miles of Earth, close enough to tempt the Marco Polo of space.

Jupiter's closest approach to Earth is 360 million miles. Although 1,300 times the size of Earth, Jupiter gravity is only a little more than twice the Earth's. When—and if—we try to go to Jupiter, the landings are likely to begin on one of the 12 moons.

These NASA interplanetary aims bear the code name of Empire, leaving no doubt of our ultimate intentions. All these projects appear possible, in one form or another. Fitting them into a logical post-Apollo scheme calls for some juggling as Apollo spending decreases within two years after the Moon landing investment.

A space station is likely to get military approval first. The civilian agency may buy into the station only to gain adequate use of it.

Then NASA can divide its funds between the permanent Moon base and the Extended Mission Apollo Spacecraft (XMAS). These projects will justify development of nuclear and chemical rockets more powerful by far than the Saturn V.

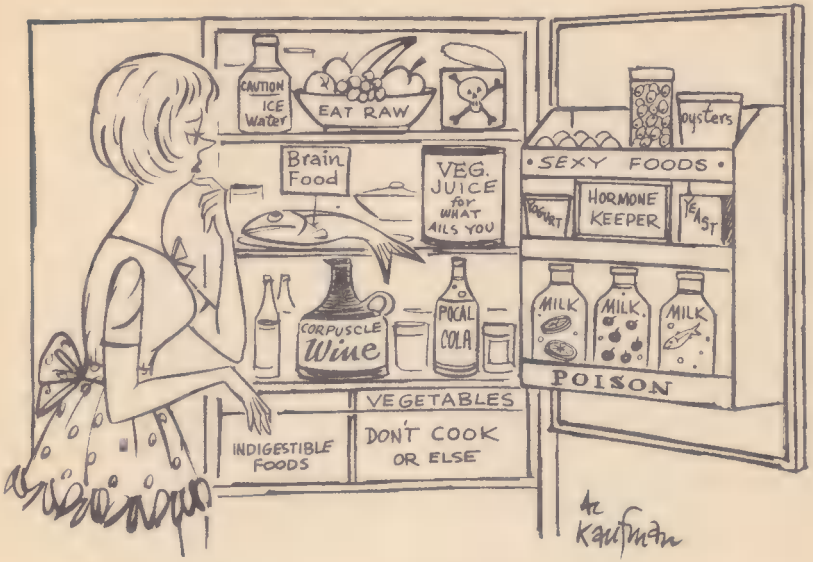
Eight months with safety

Apollo itself remains NASA's hidden ace. Until flights begin in 1966, no one will know how good it really is. The four-month flights now planned are an indicator that our space engineers believe Apollo can fly for eight months with reasonable safety. With high energy rocket fuels (liquid hydrogen or fluorine), Apollo may emerge as the covered wagon of the space age. After the Project Apollo Moon landings, it may carry men farther out than most people dare to hope.

Mars and Venus flights appear no nearer than the mid-1970's if you attempt a landing. Permanent Mars bases—like trips to Jupiter and Saturn—probably will remain as slowly ripening fruits for the 1990 period.

Lunar base projects and planetary flights offer some chance for joint ventures with Russia, if the cold war thaw continues. They are far enough away to make multi-lingual training, manufacturing and operations possible. Officials of NASA have promised that in 1965 they will attempt to pick astronauts for these Post-Apollo missions from the ranks of scientists.

The variety of future targets poses the question: How far and where does the taxpayer want to go?



21 DIET FALLACIES

by Gaynor Maddox

THE struggle between superstition, prejudice and taboos on one hand, and nutrition research on the other, slows down human progress. Biochemists relentlessly continue their search into food in its relation to life. To the dedicated researcher, physical man is a chemical complex, consisting of 50 or more elements. But in the world of inherited suspicion of progress and unexamined rejection of what is new, man seems more an emotional complex. To get him to accept the findings of modern nutrition and apply them to his daily living, despite prejudice and superstition, remains a massive problem in education.

The American Dietetic Association has for many years, through its professional membership, been an outstanding factor in cutting through the fog of nutritional ignorance.

To the inquiry "Do oysters, raw eggs, lean meat and olives increase sexual potency?" ADA's answer is, "No. These foods, as well as all others, contribute toward health and well-being, but do not have special properties which increase sexual potency," ADA states in its

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Eating fish and celery isn't going to get young people into the college of their choice. Three meals a day, a dietician says will do just as well.

educational pamphlet "Food Facts Talk Back."

Some young men and women facing college board examinations in the hope of being accepted by the university of their choice—or any university—ask hopefully if eating greater amounts of food will stimulate mental activity. The Association replies: "Additional food is not needed for mental activity. Three meals, equally distributed through the day, will support optimum work efficiency."

Further discouragement to those seeking intellectual speed-up through particular foods lies in this research finding: "Fish and celery are not brain foods." Possibly this belief arose from the fact that nerve tissue which comprises a part of our brains, is rich in phosphorous, and fish provides phosphorous-containing compounds. But meat, poultry, eggs and milk are also rich in this nutrient. Celery, however, contains only a little phosphorus.

A look at some other food fallacies and the Association's factual answers, founded on scientific evidence, may weaken the grip of ignorance on the public's attitude toward advances in modern nutrition.

FALLACY: White eggs are more nutritious than brown.
FACT: The nutritive value of an egg is not related to the color of the shell. Shell color varies from white to deep brown. Color is determined by the breed of hen.

FALLACY: Raw eggs are more nutritious than cooked.
FACT: The extent to which cooking influences the digestibility of the egg has been the subject of much investigation. The method of cooking eggs influences the rate of digestion, but only slightly affects their total utilization.

FALLACY: Vegetable juices have special health-giving qualities.
FACT: Promoters of so-called "health foods" and juicing devices are chiefly responsible for the idea that vegetable juices have special health-giving qualities. No vegetable or fruit or its juice has a specific disease-curing property.

Vegetable and fruit juices are prepared by separating, by mechanical means, the juice from the solid part of the vegetable or fruit. These juices contain the water-soluble nutrients found in the original foods.

FALLACY: Vegetable juices are more nutritious than the vegetables themselves.
FACT: The nutritive values of vegetable juices and vegetables are approximately the same. Whole vege-

tables are an important source of bulk in the diet.

FALLACY: All fruits and vegetables should be eaten raw.
FACT: The origin of this idea probably lies in the theory that foods should be eaten in their natural state. However, vegetables are cooked for two reasons: to soften the cellulose so that they will be more easily digested, and, in some instances, to make them more acceptable to the taste.

However, overcooking may cause excessive loss of minerals and vitamins.

FALLACY: Canned vegetable products have less nutritive value than fresh, cooked vegetables.
FACT: No such general statement should be made. The nutritive values of both the canned and the freshly-cooked product are dependent upon the nutritive value of the original food and the method by which it has been prepared.

FALLACY: Yogurt and brewer's yeast are requirements of a good diet.
FACT: Yogurt and other fermented milks are good foods, but they have none of the mysterious health-giving virtues which are attributed to them by some people. Yogurt costs more than whole milk.

Yogurt is made from whole milk with varying amounts of added milk solids. No difference has been demonstrated between the nutritional value of fresh and fermented milks which contain equal concentrations of milk fat and nonfat milk solids.

Brewer's yeast is an excellent source of protein of high biologic value and of the vitamins of the B complex. However, persons who daily eat eggs, meat and whole-grain or enriched cereals or bread do not need to supplement their diet with yeast.

FALLACY: These combinations are poisonous or harmful:
Milk and oysters
Milk and fish
Milk and lemons
Milk and tomatoes
Ice cream and oysters
Milk and chili con carne
Milk and spinach
Milk and lettuce
Milk and cherries
Milk and cucumbers
Milk and oranges
Buttermilk and cabbage
FACT: No experimental or clinical evidence indicates that combinations of natural foodstuffs such as those listed above are poisonous. Years of human experience with combinations of foods disprove the statements. Illness of persons from any food normally tolerated by man is due either to causes outside the food, contamination of the food, or to an individual food allergy.

The statement that the combination of fish and milk is poisonous no doubt originated in days before refrigeration, when, by coincidence, people who were eating fish that was not strictly fresh also hap-

pened to be drinking milk at the same meal.

People who refuse to eat fish and drink milk today probably never think of it as inconsistent when they eat fish chowder or oyster stew made with milk, or fish with cream sauce. If two foods can be eaten separately, they can also be used in combination without harm.

Spinach soup, spinach souffle and creamed spinach also are commonly eaten with no evidence of harmful effect.

FALLACY: Margarine is harder to digest than butter.
FACT: Research has revealed that the body digests and utilizes all food fats equally well.

FALLACY: Margarine contains fewer calories than butter does.
FACT: This is not true. The caloric content is the same in butter and margarine.

FALLACY: The continuous use of margarine adversely affects secondary sex characteristics, such as the distribution of hair and the depth of the voice.
FACT: Secondary sex characteristics are determined principally by the secretions of the endocrine glands, which build their respective hormones.

It has not been demonstrated that margarine has any substance that adversely affects the building of hormones.

FALLACY: Frozen orange juice has less nutritive value than fresh.
FACT: The major contribution of orange juice to the diet is vitamin C. These two products are remarkably similar in vitamin C content.

FALLACY: Uncolored soda pop contains no calories.
FACT: Analysis of carbonated beverages shows that they contain 80 to 105 calories per cup. Color is no guide to the number of calories a beverage contains. Sugar dissolved in water forms a colorless liquid.

FALLACY: Wine makes blood.
FACT: There is no single food which is responsible for making blood.

FALLACY: Drinking iced water causes heart trouble.
FACT: Drinking iced water will not cause heart disease. Some patients with arteriosclerotic heart disease may experience pain in the chest from different kinds of stimuli, such as the drinking of iced water.

FALLACY: It is dangerous to leave food in a can that has been opened.
FACT: The U.S. Department of Agriculture has released the following:

It is safe to keep the food in the original can after it has been opened. It is important to cover the can and keep the food cool. A few acid foods may dissolve a little iron from the can, but this is not harmful or dangerous to health. Cans and foods are sterilized in the processing. Another container might have bacteria on it, which could cause food to spoil.

Women don't grow a mustache from eating margarine any more than iced water gives you heart trouble. It's even safe to eat cabbage.

FALLACY: Sour cream contains fewer calories than sweet cream.
FACT: The calories in sour and sweet cream depend on the percentage of fat in each of them. Commercial sour cream and coffee cream usually contain 20 percent fat. Consequently, one ounce of sour cream would have the same number of calories as one ounce of sweet cream.

FALLACY: Vegetables of the cabbage and onion families, as well as cucumbers and radishes, are indigestible.
FACT: Such a generalization cannot be made. Personal idiosyncracies will explain many instances in which a food is digested with apparent difficulty. It must be assumed that many persons are peculiary sensitive to some chemical substances contained in an offending food.

FALLACY: Gelatin is one of the best sources of protein.
FACT: This statement implies that gelatin could be used as the only source of protein in the diet. This is not true because gelatin does not contain all of the amino acids needed for growth, repair, and maintenance of the body.

All over the world, deeply rooted food prejudices and ignorance block the progress of nutrition and are often the cause of severe malnutrition. Dr. Margaret Mead, a curator of ethnology at the American Museum of Natural History in New York, points out:

In the midst of famine, many rice-eating people may refuse unpolished rice because it isn't white. Orthodox Hindus will not eat beef for religious reasons. In India, with one-third of the world's total cattle population, an attempt to build a modern cheese factory failed because the stomach of a ruminating animal was needed to make the cheese.

Two "homey" ideas about food, though harmless enough, can conclude this brief survey of the prejudices and hysterias that run counter to sound nutrition. One is the emphatic conviction that a good hot meal is much more nourishing than a cold one. Your nutritionist replies that the nutrients in the food, not the temperature at which it is served, determine how nourishing it may be. Whether you prefer it hot or cold is strictly a matter of taste.

The other will be welcome news to many. Hot biscuits and bread fresh from the oven are nutritionally just as good for you as those served only when they are cold, old wives' tales to the contrary. They are both delicious with butter and honey.

INVENTOR OF THE MONTH

R. Buckminster Fuller has designed domes for world's fair exhibits.

The suspension stadium

R (FOR RICHARD) Buckminster Fuller invents, among other things, strange-looking, pillarless domes that hold radar antennas, world's fair exhibits and people. He also invents terms, such as Dymaxion and tensegrity.

The titles of some recent Bucky Fuller patents are Geodesic Plydome, Geodesic Tent, Synergetic Building Construction, Tensile-Integrity Structures and Undersea Island.

The occasion for his selection as Inventor of the Month is a recent patent (3,139,957), disclosing what he calls aspension.

"I have discovered," he said in his application, "how to make building structures and components possessing in substantial measure the advantages of catenary suspension heretofore confined principally to the suspension bridge.

"The catenary cables of the suspension bridge sag downwardly to the mid-point of the bridge, and would seem to possess no utility in any structure which arches upwardly. So it has been a surprise to me to find that there is a way by which a catenary suspension system can be converted into an arched structure of domical or polygonal form."

His suspension, or aspension, building is intended to serve as a roofed stadium or concert hall. It consists of tiers of curved, box-like frames that overlap vertically. Cables run down to the bottom of each frame from the top of the frame below.

Before the patent was issued, Fuller had designed an advanced form that he called the star-dome. One has been built near Tokyo for a Japanese country club.

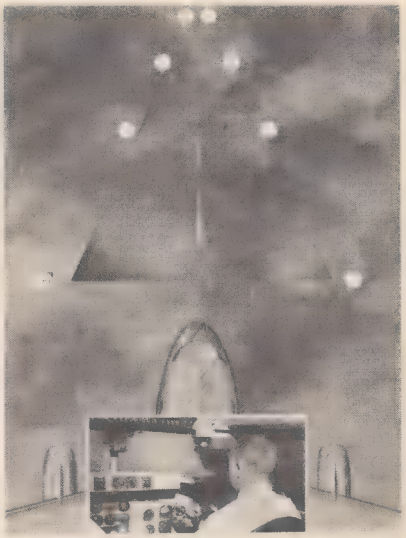
More than 2,000 Fuller geodesic domes have been built in 40 countries. The Soviet government bought the Fuller dome that housed the United States trade fair exhibit in Moscow in 1959, and made it a permanent exhibition building. Some 125 companies have been licensed to produce prefabricated parts of the domes.

As president or board chairman, the busy inventor heads the Fuller Research Foundation, Wichita, Kan.; Geodesics, Inc., Raleigh, N. C.; Plydomes, Inc., Des Moines, Iowa; the Tetrahelix Corporation, Hamilton, Ohio, and the Buckminster Fuller Institute at Carbondale.

—Stacy V. Jones

INVENTIONS PATENTS PROCESSES

Runway lights that aren't really there



The white dots outline an airport runway as a pilot "sees" it with Microvision.

Bad weather is a factor that annually costs commercial airlines millions of dollars due to flight diversions and cancellations, and has often seriously curtailed military flights. Another step in the development of a long-sought-after all-weather landing system was announced recently by the Bendix Corporation.

The new system, called "Microvision," uses microwave radio signals —beamed to the plane from both sides of the landing strip—to put a "picture" of the runway in the cockpit.

The pilot sees the electronic image of an outline of the runway through a semi-transparent screen that is positioned directly into his "real world" line of vision.

Bendix officials pointed out that although automatic landing systems make "hands off" or automatic touchdowns technically feasible, few pilots care to be back seat drivers to instrument dials during the critical moments just before landing. A pilot wants to know how well an automatic system is taking him down the approach path, and by visual reference to the ground, decide whether to take over manual control.

Present Federal regulations provide that the pilot of a jet aircraft must be able to see the runway at a minimum altitude of 200 feet and a distance of one-half mile. Under existing instrument landing techniques, the pilot follows a radio beam or "glide path"—defined by instrument panel indicators—down to the point of actual visibility.

With Microvision, which operates on radio beams completely inde-

pendent of any existing radio or other types of landing aids, a pilot is able to "see" the runway through his normal line of vision from a distance of about ten miles with the plane at an altitude of some 5,000 feet. At a distance of about seven miles from touchdown, the runway begins to come into focus, appearing as a pattern of separate beacons resembling runway lights. The pattern, which is seen in true perspective, becomes better defined as the aircraft gets closer to the runway.

Microvision consists of three essential elements—ground transmitters, an airborne receiver and a pilot's display. The ground transmitters are placed along each side of a runway in a pattern similar to conventional runway lights, and transmit pulses to the airborne receiver. The pulses, which define the angular position of each transmitter relative to the body of the aircraft, are then converted into visual images that form an outline of the runway. This outline is, in turn, projected directly into the pilot's "real world" line of vision.

More than 1000 successful flight tests with Microvision have been made since 1960.

Air-conditioned underwear

A special garment designed to keep Apollo astronauts cool was tested by race driver Bobby Isaac recently during the grueling Firecracker 400 at Daytona Beach, Fla. The garment has tubing sewn into its fabric. The tubing, which touches

Air conditioned underwear is worn under Bobby Isaac's drivers suit, left. He finished second to A. J. Foyt, right.

the skin, is filled with a liquid coolant which maintains body temperature at approximately 98.6°F despite the intense heat inside the car. Drivers usually lose 10 pounds or more during the "400" because of perspiration.

In the Apollo project the under garment will cool space-suited astronauts, allowing them to exert high rates of physical energy without running the risk of heat exhaustion or body dehydration. The underwear was developed by the Hamilton Standard Division of United Aircraft Corp.

Cooling efficiency of the garment is based on a careful layout of tubing to provide a proper distribution of cooling over the body, arms and legs. The tubing is sewn onto the garment's net fabric in a way that will not restrict body movement.

The coolant liquid pumped through the piping network was

stored in a cold box installed in Isaac's race car.

Following the 400-mile race, during which temperatures in the cars rose to 140 degrees, Isaac said in an interview:

"I didn't sweat a drop. That suit is the greatest thing in the world. I'll bet everybody will have one next year.

How did Isaac do in the race? He finished second behind winner A. J. Foyt.

University of California scientist Roy Pence tests newly developed material for protecting fabrics from moths and beetles.

Molecular monkey wrench

A UCLA entomologist has invented a new "antimetabolite" method of protecting carpets, clothing and other textiles from moths and beetles. The radically different method is said to immunize textiles, fabrics, yarns, carpets, upholstery and other articles made from, or containing, animal fibers against destruction by insect pests.

Synthetic fibers can also be protected by the patented technique because insects attack almost any fabric once it becomes contaminated with perspiration, oil from the skin or spilled liquids, such as beer which is high in the vitamin B complex.

Roy Pence developed the immunization treatment because conventional ways of killing moths and carpet beetles have two important disadvantages; they often stain or damage articles that are to be protected and they also contain toxic materials.

His technique uses non-toxic substances, called antimetabolites, which look and taste like fabric contaminants but aren't; in effect they drop a sort of molecular monkey wrench into the insect's metabolic machinery. They prevent insects from using the vitamin B complex and other essential nutrients found in contaminants. They even prevent the insect from using its own stored nutrients.

Net result of the treatment is death from acute malnutrition. It's even faster than starvation, Pence says.

Numerous metabolism-interrupting compounds, or antimetabolites, may be used. These compounds are molecularly similar to essential insect nutrients except for one or more key atoms, which are either removed or replaced with an atom that makes the compound unacceptable to the insect.

The advantages of the antimetab-

olites, says Pence, are: 1. they would be long lasting, difficult to remove by dry cleanings and in some cases wet washings; 2. they would be non-toxic to children or animals playing on rugs; 3. they would be cheap and easy to apply; and 4. they would be resistance-proof, since insects haven't yet developed a means of resisting starvation.

Comfort for the long haul

For the man whose "office" is the cab of a heavy-duty truck, a special seat has been developed.

It offers a possible combination of 864 seating positions, sets automatically for the driver's weight, and is mounted on an air suspension system that absorbs as much as 90 percent of the vibrations encountered at two cycles per second and above.

Called Cush-N-Aire, the truck seat has been introduced by National Seating company after two years of development.

Weight of the seat and driver is borne on a Goodyear nylon-neoprene air spring. The driver adjusts the seat to suit his height and weight using a pushpull button to control pressure entering the suspension system from the truck's air supply. The seat's stabilizing system operates on hardened steel pivots encased in high tensile steel with oil-impregnated bushings. Fold-up arm rests and removable seat and back covers are optional.

New Cush-N-Aire truck seat can be adjusted to 864 different seating positions.

'Nice to hear from you'

Westinghouse Electric Corp., has developed a new miniature cartridge tape recorder with the idea that it can be used to send "voice letters" by mail. The tiny recorder was designed for use in pairs so that families can communicate with one another by voice. Each recorder comes with a "ready tape mailer." When a message is completed, the tape cartridge can be removed as a single unit and it can be placed in the mailer.

Each cartridge records up to 35 minutes and requires no threading. The recorder will operate on four penlight batteries.

Other suggested uses for the recorder were for salesmen who can record important facts immediately and send them to their home offices, and students who can use them for taking lecture notes or for practicing language courses.

Additional information is available from Westinghouse Electric Corp., 200 Park Avenue, New York 17, N. Y.

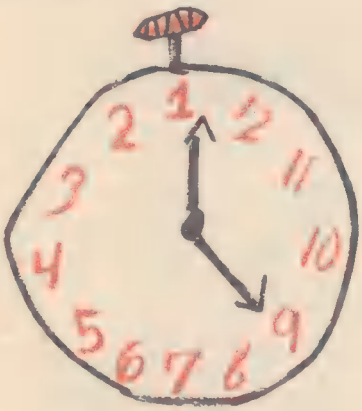
What kids say about science

by Harold Dunn

SOME of the nation's greatest humor, unintentional but nonetheless hilarious, comes from school children. Having taught elementary school youngsters for nine years, I have heard such delightful observations as these:

"Breakthroughs are good for science but bad for windows."

"Scientific knowledge is knowing things like how to make time go backward by the B.C. method."



"A scientific assumption is a fact so simple we do not need to understand it."

Sometimes they aren't wrong at all—it's just the way they say it that's so funny. For example:

"The scientific method is not to believe anybody until you find it out for yourself."

"The 'gyro-stabilizer' is a deal used to help seasickness. It hasn't completely replaced throwing up yet."

"Vacuums consist mostly of nothings."

Sometimes a youngster doesn't know and he knows he doesn't know, but that doesn't keep his answer from being charming:

"The higher we go, the lower the temperature gets for the reason of search me."

"The theory of relativity, as I understand it, is not very well understood."

From the pencil of a knowledgeable ten-year-old boy comes this bit of information:

Question: What is the internationally used scientific system of measurement?

Answer: "Hips, waist and bust."

When the kids read facts that they don't understand, they often let their imaginations take over. I came across the following "imaginary facts" about meteorology during my first year of teaching:

"Meteorology is the study of how to get climate without weather."

"Until it is decided whether tornados are typhoons or hurricanes, we must continue to call them tornados."

One intense little girl took a gratifying interest in archaeology:

"An archaeologist is an excavated prehistoric ruin."

"A fossil is a dead bone."

"I have always wanted to go look for fossils, but not very much."

"Meteorologists look something like people."

Last year, an unusually bright young lady got hold of a high school psychology book in her home library:

"B r a i n theoryists now think smartness is caused by gray matter on the brain. But as people grow older, some seeps out and gets in their hair."

"The w a y psychology differs from sociology is, play like a man kills a neighbor. Well, psychology blames the man and sociology blames the neighbor."

"Freud's greatest contribution was showing us what we should worry about. And if we do not worry, why we should worry about that."

"Sublimation refers to a strange freak of nature in which people have dogs instead of children."

The boy who sat behind her in class once confided: "I remember everything on Gamma Globulin except who he is."

This boy is the same scholar who wrote: "Government health programs are why people grow bigger than germs."

Here are three more frank, if slightly off-center, body boners:

"Genetics explain why you look like your father and if you don't why you should."

"Many questions have b e e n aroused in my mind by genes. As a mattery fact, the main trouble with genes is that they give more questions than answers."

"Biology is a spare word for when you cannot think how to say insides."

Ever heard of the word, "bombious"? I hadn't until I came across this gem: "Uranium 235 is a bombious metal."

One of my students this year has had many tussles with his spelling book. When he finished writing a sentence recently, the battleground looked like this: "Fizzics does not agree with itself spelingly and prouncingly."

Some of their mistakes have a devastating logic, i.e.:

"A person who knows about physics would be called a physician if that word had not already been taken."

"Negative charges are charges that are not really there, but we pretend they are just for fun."

Childish authorities on gravity have this to say:

"The law of gravity is maintained very enforcedly."

"When the law of gravity was first passed, it was thought that bodies attracted each other. But with the invention of electricity we found out only opposites attract. It has been that way ever since."

Question: Why would a person weigh more at either pole than at the equator?

Answer: "If you walk from either pole to the equator you are bound to lose weight."

Here's one that I've been trying to figure out for five years: "I plan to be a geologist when I can find somebody to do it on."

When members of the grade school set turn their full attention to geology, mistakes seem to come as thick as chalkdust. Here's what I mean:

"Geologists are one of the chief by-products of geology."

"The meaning of geology has a very short memory in my mind."

"Someone in here once said that there are three main types of rocks. I think this is so because I believe I was the one that said it."

"We of my famley plan to start a gathering of rocks in one of our next spare times."

One tyke tripped on the word "equinox" and stumbled into this mistake: "It took our best astromoners to figure out how to cross an equine-ox."

In the same essay, he mentions: "The solar system is a rich source of vacuums."

Another young fellow explained: "Astronomy is the same as astrology, only just the opposite."

Other youngsters had these comments about astronomy:

"The earth is revolving around the sun at the present time."

"The sun is nothing but a big rock of gases."

"A meteor is a piece of stone or metal passing through our celestial body. But it doesn't hurt."

"The earth revolves on its axles."

"Outer space means to heave a sigh at wanting to visit there safely."

Chemistry has come in for its share of classroom comment through the years. Here are some of my favorites:

"Silicon is a well-known chemical element few people have ever heard of."

"When anybody says compound, what he is saying depends on whether he is saying it to a chemist or a sentence-maker."

"One of our best odor killers is chloroform."

Then I don't suppose I'll ever forget this remark by a brown-eyed little moppet: "From now on I will put both gladness and wonder in my same thought about science."

Me, too!

Zoo to rescue wild animals

SCIENTIFIC RESEARCH and activities to preserve endangered species of wild life will be given increased attention by the New York Zoological Society.

The society's president, Fairfield Osborn, says the collection of animals at the New York (Bronx) Zoo offers unusual opportunities for investigation of comparative problems in the development and evolution of behavior. Research could be conducted in the areas of physiology, hormonal control, inbreeding, vertebrate genetics, the comparison of infant and parent relationships and the development of behavioral controls.

The society also plans to expand its work in the Department of Marine Biochemistry and Ecology. Osborn indicates that research in pharmacologically active compounds derived from marine organisms would be especially valuable because it is related to the discovery of new drugs that might prove useful in the treatment and prevention of infectious and noninfectious diseases. The society's Tropical Research Department, on the island of Trinidad off the coast of South America, will step up the study of tropical fauna and their environment.

Wild life in the United States enjoys more security than in other parts of the world, according to Osborn. Abroad, the population increase has caused man and wild life to compete for space. The threat to wild animals has been heightened by illegal shooting and poaching for food, hides, ivory and other animal products. The use of monkeys for research is one of various other factors contributing to the decline of wild life in all parts of the world.

the progress of MEDICINE

How to stop a heart attack before it starts

Arthur J. Snider

THIS is the composite of stories told to Dr. William S. Green by his patients in the last 18 years. The same theme underlies all: The body has an early warning system of an impending heart attack. If heeded, a heart attack could be averted.

Dr. Green, a Cincinnati physician, calls this warning system the "pre-heart attack fatigue." Before the heart attack occurs, the patient suffers increasing fatigue over a period of weeks. But he doesn't stop to rest, and each day the heart loses of a bit of ability to meet the taxing demands on it.

"Like the drop of water wearing away the stone, these fractions add up, until one Saturday afternoon he experiences an unexpected feeling of physical letdown and has difficulty dragging himself to the shower to prepare for the party that night," Dr. Green said.

"After a Sunday rest, he feels his old self. But during the next week, especially after a late session, he notices his ability to bounce back is slower than ever. As his letdown feeling progresses, he learns to skip his big problems. He becomes increasingly irritable at himself for not being able to respond as he thinks he should."

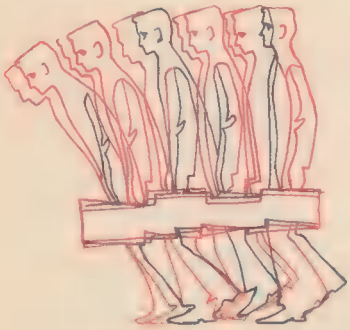
The first appearance of "pre-heart attack fatigue" usually occurs at least six months before the attack itself.

"It recurs in an intermittent fashion and its presence or absence depends on the willingness of the individual to listen to the messages and to rest sufficiently," Dr. Green continues.

"If rest is not adequate, the body recognizes the hopelessness in carrying on in the face of constant whipping. The patient moves into the 'progressively increasing fatigue' stage."

This is manifested by a letdown on Friday afternoon. Rest on Friday night enables him to bounce

back Saturday morning but he is unexpectedly tired on Saturday afternoon. He's still tired on Monday despite a full day of rest on Sunday.



Finally, he goes to a physician only to find that all tests are negative. He may then try his own remedies—giving up smoking, taking vitamin or pep-up pills or going on an exercising regimen.

Inevitably, he moves into the "absolute fatigue" stage in which he has difficulty dragging one leg after the other. He uses every excuse to sit and rest.

Then one day comes the fateful "heart roulette." He may be bowling or exerting himself emotionally or he may overeat or undergo an extreme of temperature. This extra demand on his heart to increase its work load is the final straw. The heart has no more to give. The point of no return has been reached.

If he is lucky, says Dr. Green, the heart may give only a stern protest in the form of a severe angina pain. If the patient accepts the protest, there is still time to escape without damage.

If he is moderately lucky, he will have a heart attack, collapse and survive after hospitalization. If unlucky, he will be dead within minutes.

Except for older individuals, who forget their limitations and engage in shoveling snow, Dr. Green has never found a case where the patient did not have an adequate "washed out" warning well in advance of a heart attack.

Treatment is rest — not a single night's rest or a weekend rest, but a two-weeks' rest, in a hospital, if necessary. Vacations are rarely rest periods for few people genuinely loaf on them.

Why don't patients heed their fatigue signs? Dr. Green finds: The drive for material gain and security, the feelings of indestructibility ("It can happen to others but not to me. I'm too tough.") and the attitude of indispensability ("The business can't go on without me.") are largely responsible.

Housewife in a space suit

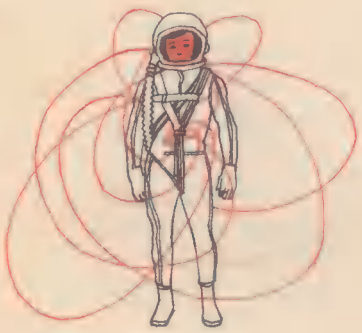
As she moves about doing her housework, Mrs. G. wears a modified space suit.

She doesn't anticipate going into orbit. She's content to walk upright on Earth, even though it requires an anti-gravity garment to accomplish it.

Mrs. G. is afflicted with an unusual form of fainting. The moment she steps out of bed in the morning,

the room starts to spin and her vision blurs. She swoons and falls to the floor unconscious.

Doctors could find nothing wrong with her except that she has "idiopathic orthostatic hypotension," meaning that on standing erect, she develops low blood pressure from unknown origin. An insufficient amount of blood reaches the brain.



It is not uncommon for healthy persons to develop momentary low blood pressure, particularly if they have been immobilized for some time, such as lying in bed or after long airplane or auto trips.

Astronauts Walter Schirra and Gordon Cooper were wobbly and dizzy for a brief period after stepping out of their capsules following prolonged orbital missions.

This results from pooling of the blood in the lower part of the body. Physical activity quickly promotes a squeezing action by which the blood is milked upward to the heart and into the brain. The process is abetted by a series of valves in the veins which prevent a back flow toward the pull of gravity.

In Mrs. G.'s case, the blood remained pooled. Apparently her system of vein valves is faulty.

For eight years she had been treated by physical means, such as elastic stockings, and by a variety of drugs to boost the blood pressure.

"They were ineffective or poorly tolerated," said Dr. Joel M. Levin, of Michael Reese Hospital, Chicago, in the *Archives of Internal Medicine*.

Then the idea of an anti-gravity suit was hit upon. One was obtained from the commanding officer of the hospital at Chanute Air Force Base, Ill.

By inflating a rubber chamber after the suit was put on, pressure was placed on the toneless veins. This permitted her to stand for any length of time.

But the suit required an assistant for fastening, lacing and inflating. It was not comfortable to wear.

The hospital has since obtained a commercially-made counter-pressure suit. Now Mrs. G. is no longer housebound. She is fully ambulatory and can wear ordinary street clothes over the underwear-like garment, which is comfortable even in warm weather.

When the sun goes down

The flattering look of modern sunglasses is causing millions of Americans to overdo a good thing.

They are wearing sunglasses when they shouldn't.

Take them off after sundown, warns the American Medical Association. They reduce the intensity of the field of vision. If an oncoming car should not have its headlights on, you might have an accident. It is easy to miss seeing a pedestrian or a cyclist.

There is no scientific evidence to support any claim that the use of tinted lenses improves night vision by blocking out oncoming headlights.

Charcoal broiling and cancer

Charcoal broiling of meat can yield a chemical compound known to produce cancer in mice. Two Chicago Medical School investigators have done it with 15 large steaks, each weighing about 2.4 pounds each. The outer portion of the "well-done" steaks were scraped and 15 compounds isolated by sophisticated chemical techniques. One of these was benzo(a)pyrene, a hydrocarbon used to induce cancer in laboratory animals.

Doctors William Lininsky and Dr. Philippe Shubik report that the quantity of the hydrocarbon obtained from one steak was equivalent to that found in the smoke of 600 cigarettes.

Most likely source of the hydrocarbon is the melted fat that drips on the hot coals and is broken down by high temperature. They are deposited on the meat as the smoke rises.

Since the production of the cancer-producing hydrocarbon is related only to the fat in the meat, the physicians recommend cutting away as much of the fat as possible.

They stress that findings in mice do not necessarily extend to man.

A medical first

In a surgical first, a nerve graft has restored the sense of touch in the hand of a California schoolteacher. Dr. Leonard Marmor of Los Angeles replaced a missing three-inch segment of Mrs. Blanche Sheets' median nerve which had been lost in an injury. The nerve graft was taken from the amputated leg of another patient.

Nerve grafting has been a complete failure in the past except for a few grafts from one part of the body to the region of the ear or fingers of the same person.

The loss of the nerve had caused Mrs. Sheets to drop papers in the classroom and even burn herself. At the American Medical Association convention, where Dr. Marmor reported the successful transplant to the right hand, Mrs. Sheets shook hands with visiting physicians.

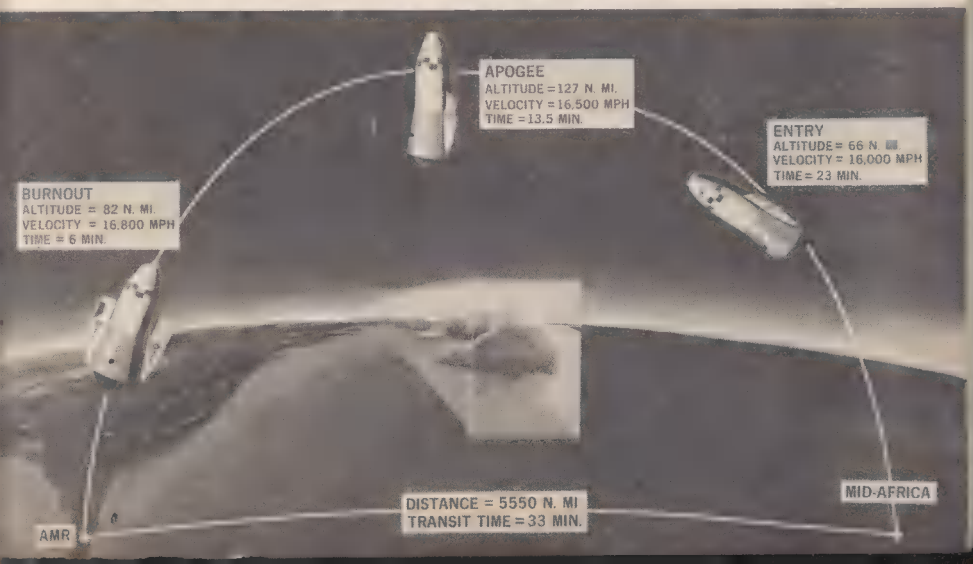
1,200 men in a rocket

Armies of tomorrow might disembark from rockets that could carry them anywhere on earth in only 45 minutes.

ITHACUS, the projected rocket shown above, could be anywhere on earth in 45 minutes, carrying—not an atomic payload, but a pretty stiff punch all the same—a battalion of 1,200 combat-ready troops. It could take off from anywhere and could touch down without needing prepared runways, even on the deck of a carrier. The soft landing would be accomplished by means of controlled retrorocket thrust.

Ithacus is a product of the drawing boards of the Douglas Missile & Space Systems Division. No major break-throughs go into its concept. Its forebears are the Saturn V rocket, targeted for the moon in 1970, and ROMBUS (Reusable Orbital Module and Utility Shuttle), developed last year for NASA in a Douglas study. Ithacus would develop enough power to send it along at close to 17,000 mph.

Rocket would "nose-up" at its apogee to start the tail-first descent to its target area.



INSIDE PSYCHIATRY TODAY

The psychopathology of politicking

by Flora Rheta Schreiber and Melvin Herman

WE ARE about to vote. The arguments are hot. We feel certain about our positions.

What, however, is behind them? Do we vote the way we do because we are human beings who take the issues seriously? Or are there other motives that propel us without our being aware that they exist?

Psychiatric investigation reveals that there are. Hatred, for instance, is a strong political motivation. "The prominence of hate in politics," Dr. Harold D. Lasswell wrote in his book *Psychopathology and Politics*, published 34 years ago, "suggests that we may find that the most important private motive (in politics) is repressed and powerful hatred."

Lasswell's book, recently reissued with a chapter on the author's afterthoughts today, has been a storm center through the years. He claimed that psychoanalytic techniques could reveal the private basis for public acts and said that we shift our unresolved family struggles on to public figures, who become the targets of our conflicts.

"Sons whose fathers frustrated their needs for love, dependence and a masculine frame of reference," Dr. Richard E. Rennecker, a research psychiatrist at the University of California, adds, "do not really speak for a candidate, but always against one, as an expression of strong unconscious hostility toward their fathers."

The contention of both these authorities is that our behavior—political action along with the rest—is largely determined by the great unconscious depths in man's personality.

Take, for instance, the woman voter of liberal tendencies, cited by the eminent psychiatrist, Dr. Franz Alexander. Intending to vote for Adlai Stevenson in 1956, she changed her mind after his quip, "Eggheads of the world unite. You have nothing to lose but your yokes." "I can't," she told Dr. Alexander, "visualize a President who is capable of making such flippant, witty remarks." Dr. Alexander explains, "She had an emotional need for a father image to which Stevenson could not live up." Her personal need to relate to her president was deeper than her reasoned principles. Her surface thinking might have been totally unrelated to her deeper self.

Take another example. A young man refused to vote for Candidate X just because he was able to identify himself with that candidate. The explanation, again offered by Dr. Alexander, was that the young man believed that the candidate suffered from similar emotional problems to those he had himself. He had great personal guilt which he felt would be punished by failure and humiliation. He could not face having this candidate run, be defeated and suffer the humiliation for which he felt that he himself on a different level also was heading.

Admittedly this young man, a psychiatric patient, was unbalanced. The unbalance, however, serves as an intensification of the unconscious forces that drive normal persons. "Personality research," Dr. Lasswell says, "shows that the individual is a poor judge of his own interest. He is so poor a judge that, instead of taking the course that will give him a happy, well-adjusted life, he often chooses one that will not. How much more devious is his behavior toward remote social objects (voting, for instance), where action is unrelated to personal experience. His voting is likely, more often than not, to be not healthy, not productive of his own best interests, but symptomatic of his deeper conflicts."

But voting in response to complex motivations is hampered by the two-party system. It offers only four possible choices, namely (1) voting a straight Democratic ticket, (2) voting a straight Republican ticket, (3) splitting one's vote and (4) refusing to vote. In such a framework there is just no chance, he feels, to express one's real feelings and attitudes. Refusing to vote is often a protest not against the candidates themselves, but against

What orients presidential candidates toward power? There is ego to see the grandiose image of self, an ego that may be built in the nursery.

this cooped-up lack of genuine expression. A well-known psychiatrist, with whom we discussed the question, just does not vote. What happens at the polls seems to him too distant, too impersonal. Despite the millions of words written about candidates, he feels that he doesn't know them except through distorted lenses. He just doesn't bother. He is not an apathetic citizen, but a man who has demonstrated active interest in his community.

Three reasons for not voting are offered in a recent sociological survey. They are (1) fear of the consequences, (2) feelings of futility of individual action and (3) no incentive. Clearly *not voting* can be a deep-seated, complex reaction.

This, however, is not the whole story. Social scientists and practical politicians alike believe in a voter who follows a reasoned path. James Haggerty, the political strategist, for instance, told us, "There are just two reasons behind every vote: (1) Is the party in power leading the country toward war or peace? If peace, the incumbent is re-elected. (2) What effect will the election have on our pocketbooks? Haggerty insists that the voters in Wisconsin, for instance, cast their ballots for Alabama's Governor George C. Wallace in the 1964 primary not because they cared a fig for his views, but because they were low men on the economic totem pole and feared that more jobs for Negroes would mean fewer jobs for them.

Some psychiatrists, too, oppose the view that men are largely driven by unconscious motives in their political action. These psychiatrists believe that Dr. Alexander's patient, refusing to vote for the candidate with whom he made identification, might have done so quite rationally. Perhaps, as Cornell University sociologist Walter Berns points out, "this very patient, being a neurotic himself, concluded that a neurotic (and he saw the candidate in his own image) would make a poor President."

At the moment we are confronted with two candidates who fulfill the father image. For both Lyndon B. Johnson and Barry M. Goldwater are strong family men, authoritative figures and older than John F. Kennedy, who could not assume this image for all the reasons purely of chronology. If we vote solely for a father figure, we logically can vote for either one, which brings the whole issue to an absurd impasse.

Whether we vote for a father fig-

Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

ure or not, we are likely to make a father of the President once he takes office. Dr. Berns points out that President Washington, the Father of our Country (and the sobriquet is no accident), was mourned as a father and that his death reactivated many unresolved Oedipal problems, even in that pre-Freudian era when an Oedipal problem as such was yet unnamed.

President Roosevelt was a strong father figure. His death meant temporary terror over who would be the head of the nation's household. The father was gone and there was fear that no one could take his place. Yet it wasn't long before President Truman, emerging as a cocky, confident fighter who wouldn't back down for anyone, became a father figure, too. When he attacked a music critic for panning his daughter's singing performance, the press criticized him. But there was also a public pride that "my father can lick any father on the block," that Father President was going to take no nonsense from anyone assaulting his flock.

It was not Truman as a father figure who was voted into office, however, but the Truman who represented a certain political position, Dr. Berns believes. Berns backs up the Haggerty concept.

What then, in these shifting sands of conscious and unconscious motivations, actually determines the vote? We cannot dismiss unconscious motivations, for there is too much evidence that gives them credence. Long before Freud, it was common to describe the psychopathology of kings and generals. Part of the early impact of Freud was to re-emphasize the importance of personality in social processes.

What kind of personality rises to the Presidency? It is a handy bromide to categorize all Presidents and all candidates as power-oriented. Of course they are power-oriented, just as the composer is music-oriented or the writer is word-oriented. Power is the stuff of which politics is made.

What orients them toward power? The answer, as with the composer or the writer, lies in a complex of genetic and environmental factors. For the Presidential candidate, however, there is a great deal more than the predisposition toward the "job." There is the accident of being in the right path and the doggedness of knowing how to walk it. There is ego to see the grandiose image of the self, an ego that may well be built in the nursery through factors as yet largely unexplored.

Practically speaking, the issue is not whether the candidate is power-oriented, but how he uses his power, just as for the voter the issue is not alone whether he votes, but whether he does so with maturity that makes that vote meaningful. There are multiple causes for any action, as Dr. Bertram Schaffner pointed out in discussing a lecture Dr. Lasswell prepared for the Academy of Psychoanalysts. Pyschoanalysts are modest enough to realize that psychiatry does not have final answers

In a New York store with a growing accident rate, everybody who had an accident had to see a psychiatrist. Accidents dropped 30 p. c.

to complex socio-political questions. As long as there is immaturity there is psychopathology. Since the mature mind is rare, we are confronted with the fact that the will toward rational political actions is muddied in the waters of inner conflict, and with voting for candidates for extraneous reasons, such as "I don't like his face."

Psychiatry on your job

A department of a large industrial firm in New York City was known to the rest of the company as "the sick department." In this department, backaches, hypertension, colitis, nervous breakdowns, frequent absenteeism and spur-of-the-moment resignations were the rule. Enter the Division of Organization Psychiatry of the Institute of Psychiatry at Mount Sinai Hospital (New York City). This group, under a three-year Federal grant, is studying how a psychiatric team can help industrial concerns, schools, unions and churches.

Milton R. Sapirstein, M.D., who is in charge of the Division, decided to begin at the top by evaluating the head of the department. It became clear that the boss was making his staff sick. He was tyrannical, arrogant, authoritarian — the traditional, cartoon-like "bad" boss of everyone's nightmare. Ironically, too, he had a strong tendency to engage the kind of person who had precisely the same rigid personality that he had. This naturally compounded the tension.

The solution recommended by Dr. Sapirstein's team was (1) to kick the boss upstairs where he no longer had any direct contact with employees, and (2) to scatter the members of his staff among other departments of the company. "Once they were placed elsewhere," says Dr. Sapirstein, "they showed a marked tendency to ingratiate themselves with their new colleagues." The result was that, chameleon-like, they began to drop the personality of their former boss and to assume instead the behavior of their new associates.

For a large New York City department store, this same psychiatric team went to work on the problem of the store's growing accident rate among employees. Every employee who had an accident had to see the psychiatrist. This requirement led the accident rate to drop thirty percent. "The employees," says Dr. Sapirstein, "unconsciously avoided accident-causing incidents in order to keep from having to see the psychiatrist."

The presence of a psychiatrist on the scene, morever, whether in an industrial concern, a store, a union, or a church — has led to unexpect-

ed bonus effects. Persons with marital problems, for instance, have come to the psychiatrist for help, using him as the means of unburdening themselves, particularly during the problem's initial stages, when help is most useful.

The future plans of this group include a retirement center in a hospital setting. Such a center would mitigate against the bitterness between employees and their companies after the day of parting. Studies have showed that persons on fairly high management levels entertain unrealistic attitudes toward retirement. Many cannot believe that they themselves will ever be separated from the company. Many, living a grandiose dream of success, see retirement as the abrogation of the success image. However, when the psychiatrist points out that the diminution of the drive toward success emancipates other, more fulfilling drives—creativity, community activities, human relationships—a new attitude toward retirement generally emerges.

School grades aren't everything

Success in a chosen profession and school grades are not one and the same. This should bring comfort to the parent who believes that Johnny's report card misrepresents him, and to the educator who has long been dissatisfied with grades as a measure of educational achievement and growth. This is the opinion of Dr. Milton R. Sapirstein of Mount Sinai Hospital, New York City.

You'll have a better understanding of your child's potential from what some psychiatrists now call his "cognitive style." Cognition in this sense is used as the generic term for the process by which an individual obtains knowledge of his environment. Involved are: perceiving, recognizing, conceiving, judging and reasoning. Everybody, moreover, shows a consistent pattern in these respects, Dr. Sapirstein believes.

Teachers, accordingly, should be aware of different personality styles of thinking — a style for future artists is different from that for engineers. Everyone would be better off if educators and the rest of us judged him on the basis of his distinctive individuality without reference to comparisons. It is the individual style, moreover, that moulds his creativity in his chosen field and becomes the bedrock on which to erect the superstructure of his achievements, he concludes.

IS MAN destined to be downgraded to the role of babysitter for computers? John Wilkinson, a staff member of the Center for the Study of Democratic Institutions, is afraid it may come to this. What with feedback and unpredictable secondary effects and computers' getting their input from the efforts of other computers, "the erstwhile servant has become or is rapidly becoming the master and displaying what very much looks like free will."

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Science's exciting new frontier

Nearly all the matter in the universe is in the plasma state. Yet it is only within the last 10 years that scientists have begun to recognize how common plasma is. What they are discovering now will affect all areas of human affairs.

by Sanborn C. Brown

It is very seldom in the life of a scientist that a whole new vista of knowledge opens up before him. But this has really occurred in plasma physics.

In physics a plasma is defined as a neutral collection of electrons and positive ions (atoms which have been stripped of their electrons) which move around in random thermal motion. We have discovered that this is the most common form in which matter is found in the universe. If you go out into the far reaches of so-called empty space, or to the stars or the solar system, or almost anywhere in the galaxy except the peculiarly cold bit of dust we call the Earth, you will find matter in this ionized state, the plasma state. Nearly all of the matter in the universe is in this state, yet it is only within the last 10 years or so that it has been recognized as a common state of matter.

To bring order into a fairly chaotic collection of phenomena, I refer you to the graph on page 85 in which the nature of matter is defined in terms of two variables: the density of electrons per cubic meter and the temperature at which these electrons are to be found. This diagram shows the various areas covered by plasma physics.

Let us begin in the lower left-hand corner of this diagram. If we get to very cold electrons and to very transparent matter, we are in interstellar space, including any nebulae we find in a study of the sky. It has not been very long since all our information about the interstellar space came from visual telescopes. Collections of charged particles such as electrons and hydrogen nuclei, which are dancing

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around in space, but which are still held together by their mutual gravitational attraction, are not necessarily visible optically but may be visible by radio telescope. We call these collections "stars."

Interplanetary space, that is, space within our own solar system, which on the average happens to be kept warmer because we have the hot sun in our vicinity, reaches temperatures of around 10,000 degrees K. In interplanetary space the number of particles per cubic meter, except when we actually get to the surface of a planet, is fairly small, between a million or perhaps 10 million particles in each cubic meter. This is fairly transparent space. The interplanetary plasmas are of extreme importance to modern science because it is through this medium that we must travel if we are to go out any distance from the surface of the earth. The physicists and engineers who are involved in space research are studying the mechanisms and the interactions of the plasma state in these interplanetary regions.

Perhaps the one astronomical area that has been studied the most is the Earth. Around it there is a charged blanket resulting from the fact that the atmosphere attached to the earth is being bombarded by solar radiation and the solar radiation produces a plasma from the neutral gasses which make the earth habitable. This layer is called the ionosphere and always insulates us from the outside space. This plasma blanket around the earth has been well known for a long time. It is relatively cold, 1,000-10,000 degrees K, and the electron density can get fairly high, up to about 10^{10}-10^{11} electrons per cubic meter.

Chart (right) shows the relationship of various types of plasma in terms of the temperature of their electrons and the density of electrons per cubic centimeter.

Very interesting and important phenomena occur as a result of this ionospheric blanket. Well known to radio engineers is the fact that you can bounce radio waves off the ionosphere.

Belts of plasma

Recently the newspapers have been full of another phenomenon which was predicted theoretically long ago but actually found experimentally only a few years ago when we started sending up rockets and high-altitude balloons. This has been called the "Van Allen Belts." These belts are areas of plasma concentration which have been caught in the inhomogeneous magnetic field around the earth. If you put a moving electron in a magnetic field, it has a tendency to go around in a circle, the diameter of which is inversely proportional to the magnetic field. If a charged particle is high above the earth somewhere near the equator, where the earth's

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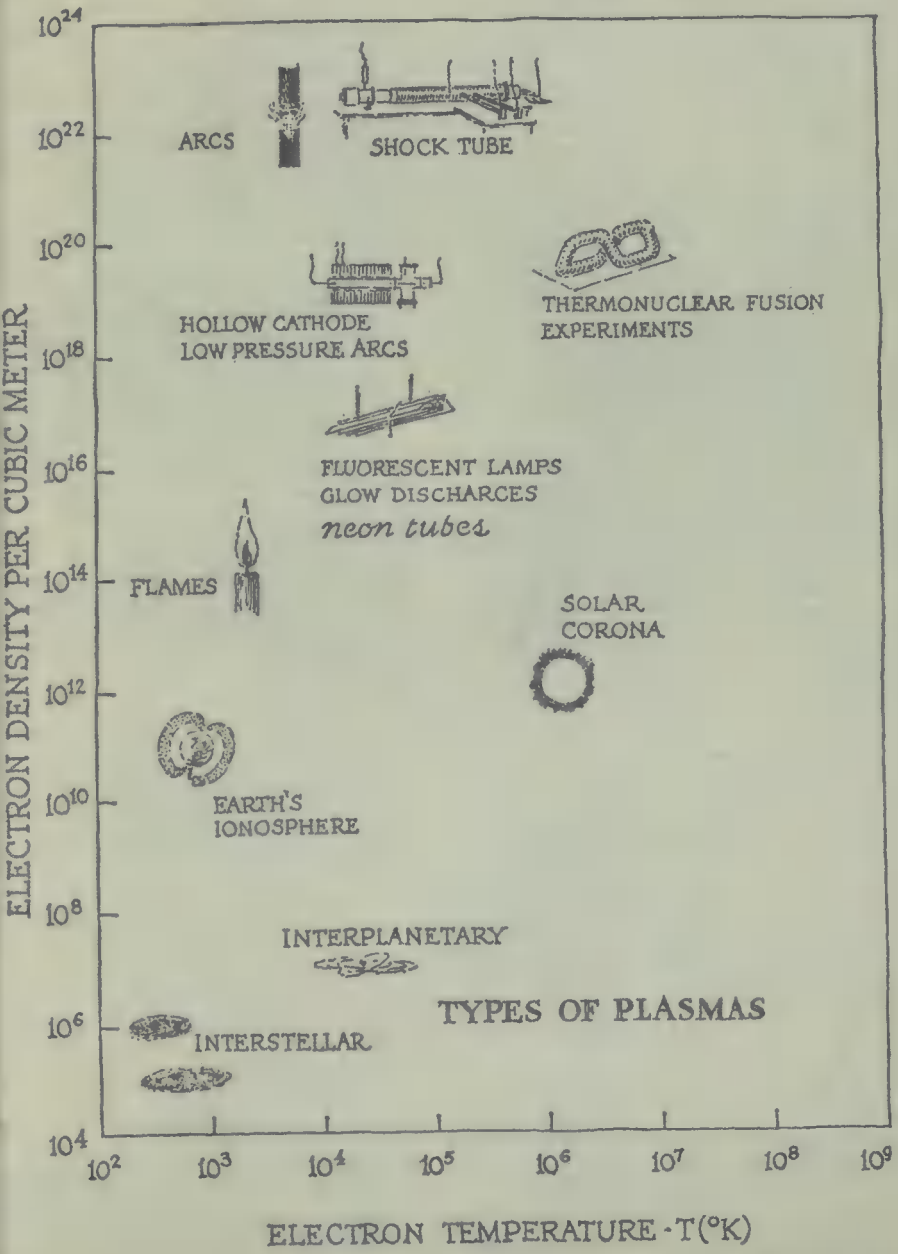
Prof. Sanborn C. Brown is associate dean of the Graduate School at the Massachusetts Institute of Technology.


ELECTRON DENSITY PER CUBIC METER
10^{24}
10^{22}
10^{20}
10^{18}
10^{16}
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10^{12}
10^{10}
10^{8}
10^{6}
10^{4}
ARCS
SHOCK TUBE
HOLLOW CATHODE
LOW PRESSURE ARCS
THERMONUCLEAR FUSION
EXPERIMENTS
FLUORESCENT LAMPS
GLOW DISCHARGES
neon tubes
FLAMES
SOLAR
CORONA
EARTH'S
IONOSPHERE
INTERPLANETARY
INTERSTELLAR
TYPES OF PLASMAS
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
10^{7}
10^{8}
10^{9}
ELECTRON TEMPERATURE - T(°K)

Generating stations will have no moving parts. They'll use plasma produced by either nuclear power, fission heat, or chemical reaction.

magnetic field is not very strong, it goes around slowly in a big circle, but as it gets closer to the pole, where the strength of the magnetic field is greater, it must move in smaller and smaller circles. In shortening the radius of the circle, a radial force is applied, and in conserving its angular momentum the particle speeds up so that it not only moves in tighter spirals but goes around the tighter spirals more rapidly. In the Van Allen belts, the plasma particles are caught in a gigantic "magnetic mirror." As these ions and electrons approach the poles, they are wound in tighter spirals, but as they rotate faster in smaller circles they conserve energy by moving more slowly toward the poles. In fact, they actually slow down and stop, and are then reflected by the mirror into reversing their directions. They go back and forth, caught in the Van Allen belts.

The mirror effect is not perfect, and the charged particles leaking out the ends of the Van Allen belts cause the northern lights, or the aurora borealis. This electrical discharge is the visible indication of the ionosphere, or the charged plasma, escaping out the ends of the Van Allen belts.

Our very existence depends upon our greatest plasma source, the sun. Its energy comes from the process we call thermonuclear fusion. Two heavy hydrogen nuclei are fused in such a way that helium is formed. There is energy left over which keeps the process going and incidentally keeps us warm. The whole process of the operation of the sun is a nuclear reaction occurring in the plasma of the sun itself.

Early plasma sticky

Perhaps one of the earliest plasmas studied as an easy way of producing a neutral collection of electrons and ions was a flame. A flame even from a candle is not very hot, maybe 1,000 degrees K, but it is extremely dense because it occurs at atmospheric pressure. Chemical flames themselves are not usually studied, but many varieties of chemical or electric "torches" produce plasmas which are not only laboratory tools for increasing our understanding of the plasma state but are technically important tools for such varied operations as welding or chemical synthesis.

Also meteors burn up when they come into the atmosphere and are reduced to the plasma state. Much of our information about meteoric physics and chemistry comes from studies of the behavior of this plasma state.

If you go to a plasma a little hotter than a flame, and a little denser, you come to the most common everyday form of plasma, a gas discharge tube of some sort, a neon sign or a fluorescent light. Most of the original studies of the plasma state were done in what was called a "glow discharge" because this was a readily available way of producing a plasma to study in the laboratory. A great deal of the information we are now gaining about the ionosphere, the sun and interplanetary and interstellar space comes from studies made in the laboratory with a glow discharge.

If we continue to pour more and more energy into an ordinary glow discharge, it turns into what we call an "arc." Arc studies in the laboratory provide us with powerful tools for studying the behavior of the plasma of the sun.

The high-pressure arcs are the densest form of plasma that we know. Here, all the material that is in the arc is ionized; everything is in the charged state. Here the theoretical studies are the most characteristic of a plasma because the plasma is pure, undiluted by unionized gas.

Here also some very practical devices are being worked on, particularly the "magnetohydrodynamic energy converter." In a conventional turbine, gas energy is converted into the kinetic energy of a moving conductor which then generates the electricity by cutting lines of magnetic flux, but if a gas conductor, a moving plasma, is used, the intermediate step is completely eliminated. The plasma moving in a magnetic field produces a flowing current which will allow us to produce generators without any moving parts. There are plans for building very large generating stations by this scheme in which the plasma is produced by either nuclear power or fission heat, or from a chemical reaction.

Making very dense plasmas and going a little farther up into the temperature region of 100,000 degrees K, we find the "shock tube" as a plasma production device. When a mechanical shock wave is driven down a tube faster than the velocity of sound, the shock wave acts as a piston. Just as with a bicycle pump, you get heat because the piston is pushing against the gas and doing work on it, so in the shock tube you can produce very high temperatures.

The heat of shock waves

Some of the highest temperatures we have achieved in the laboratory are produced by shock waves.

Another phenomenon, which has been known to physicists for a long time but has only recently received attention in the popular press, appears when we try to pull astronauts back out of interplanetary space through our own atmosphere. When a capsule comes down through our own atmosphere, it produces a shock wave ahead of it which is so strong that it builds a plasma sheath all the way around

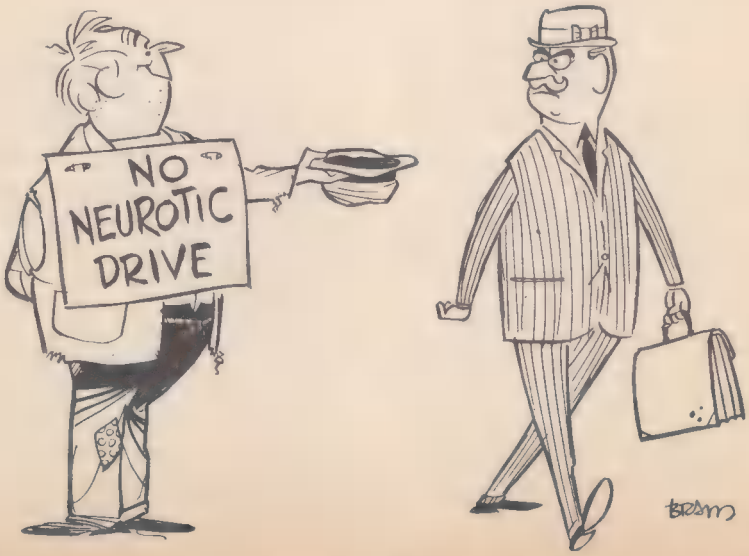
the astronaut, and our communication with the astronaut disappears.

Physicists and engineers have been spending a great deal of their time in a search for a way of producing controlled thermonuclear fusion. We all know the sun is hot. At those temperatures a controlled thermonuclear reaction is produced.

We would like to be able to carry on the same reaction in a controlled fashion on the surface of the earth. The advantages would be tremendous. For one thing we are going to run out of fuel to produce power if we keep on using fossil fuel. The fission fuel is rather dangerous because radioactive products are left over after the reaction. If we went completely to fission power, we would eventually have difficulty in disposing safely of all the radioactive waste. The thermonuclear reaction has no radioactive waste. It ends up as ordinary helium. Furthermore, its fuel is a plentiful isotope of hydrogen, found in all water.

Wherever human beings are, there is water, and you can burn this water to produce thermonuclear reactions. We know that a thermonuclear reaction works because the hydrogen bomb is exactly this: by exploding a fission bomb in contact with the hydrogen isotopes, you heat them so hot that the fusion reaction takes place. We would like to be able to do this in a controlled way in the laboratory; we have not yet succeeded.

The plasma physicist finds himself riding the leading edge of science. Tremendous endeavors are generated whose influence reaches into all areas of human affairs. The sensation is exhilarating.



Minerals

WEALTH IN THE EARTH'S CRUST

MINERALS are inorganic substances which form most of the earth's rocks or fill the cracks and hollows within them. Minerals found in the cracks of rocks have usually been deposited by water in the form of fairly pure crystals, but some have been forced into the cracks in the molten state from pockets of hot rock deep below the surface. Many of the purer minerals are mined for the extraction of the chemical elements they contain, those which yield metals being called "ores."

Metallic ores are usually combinations of the metals with oxygen, sulfur or carbon, in the form of oxides, sulfides or carbonates. A common sulfide of iron is "iron pyrite." This is found as small, heavy brown nodules in clay, chalk and other rocks; but sometimes it has a glint that has caused iron pyrite to be called "fool's gold." It is difficult to prepare pure iron from the sulfide, so pyrite is more often used as a source of sulfur in the manufacture of sulfuric acid.

Other valuable sulfides include the principal ore of lead, "galena," and the brilliant vermilion-colored sulfide of mercury, "cinnabar." Zinc is also extracted from its sulfide, the mineral being known as "blende," but another source of zinc is "calamine" or "zinc spar," which is zinc carbonate.

Where copper is found

An important ore of copper is "malachite," a brilliant green stone consisting chiefly of copper carbonate. Copper is also found in the rocks as thin sheets of the pure metal. Gold is also found in the pure state, either as "nuggets" or as "veins" in quartz. Silver is sometimes found in the form of pure silver "wire," but it is usually extracted from its sulfide, which forms "silver glance," or from the chloride in "horn silver."

Minerals required for the chemical industry include rock salt, of which great beds exist where ancient

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salt seas have dried up and become buried, and "gypsum," which is calcium sulfate. Gypsum is found as clear white crystals but also, in an impure state, as a massive rock called "gypsite." It is ground and roasted to form "plaster of Paris." Another valuable mineral rock is magnesium limestone, the stone of which is used in the Houses of Parliament in London. Magnesium limestone contains magnesium as well as lime, though ordinary lime is usually made from a pure limestone like chalk, by roasting it.

Other important minerals include "nitre" or "saltpeter," "fuller's earth" (a kind of clay used for removing grease from wool), asbestos and mica.

Kaolin, a type of clay used in making china and porcelain, is formed naturally by the weathering of feldspar in granite. Quartz or "rock crystal" is also found in granite and many other rocks, and has many uses in commerce, especially in glass making.

Optics

THE SCIENCE OF SIGHT AND LIGHT

Optics is the study of the behavior of light, and to understand this it is necessary to have some idea of what light is. The people of ancient times believed that light is something that comes from our eyes. When you look at an object, they thought that your eye sends out a sort of tentacle or feeler to light up the object and show it to you. This seems to us very absurd today, for we now know that light consists of electromagnetic waves, like those used in radio but of much shorter wave length, and that these waves travel in straight lines.

Light waves themselves, like radio waves, are invisible, but when they are reflected from an object so as to enter the pupils of our eyes, they stimulate our nerves so that we see a little "picture" of the object. Most ordinary objects scatter the light which falls on them in all directions, and the rays which reach our eyes have to be put in order before all the details of the object can become clear. This is done by a small lens, like a camera lens, situated in the pupil of each eye.

Refraction of light

Light waves can travel through empty space, for they reach us from the sun and stars, but it is hard to imagine how they leap across the gap of millions of miles. You cannot imagine waves of nothing, but if there is nothing in empty space, how do the waves travel? Some scientists answered this question by supposing that

space was really filled with "ether," so that light waves could be thought of as waves in the ether. Just as sound needs a substance like air to travel through, so it seemed sensible to suppose that light, and other similar waves, needed a "medium" of some kind to go through.

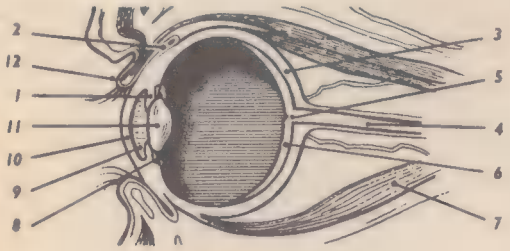
No such medium has ever been detected, but the difficulty has been overcome by supposing that light really consists of little packets of energy that can travel in the form of little tiny particles much smaller than atoms. They are called "photons," and one of the problems that modern scientists are trying to solve is how light can behave like waves and particles at the same time. The two different ideas have been joined into one satisfactory explanation, but it is such a complicated process that a great deal of advanced scientific knowledge is required to understand it.

We have seen that shadows of objects, and shadows or eclipses of the sun can be satisfactorily explained by supposing that light travels in straight lines.

We know that light of different wave lengths produces different sensations of color, and that sunlight is a mixture of all the colors of the rainbow. The atoms of many substances are able to absorb light of certain wave lengths, but not others, and this is why some objects appear colored. For example, when sunlight falls on to a green leaf, the leaf absorbs all the red wave lengths and reflects only the green ones. The paint on a red fire box, on the other hand, absorbs green rays and reflects red ones.

Going millions of miles

The fact that light is reflected from mirrors according to certain fixed rules or laws of reflection, is put to good use in many instruments where mirrors are needed. There are also rules or laws which govern the way light is bent or refracted when entering one substance from another. Knowledge of these has enabled us to construct lenses of various kinds for spectacles, and for many other instruments such as the microscope, telescope, camera, movie and slide projectors, spectroscope and a host of other optical instruments.



1, iris; 2, conjunctiva; 3, sclera; 4, optic nerve; 5, blind spot; 6, retina; 7, eye muscles; 8, ciliary muscles; 9, aqueous chamber; 10, cornea; 11, lens; 12, eyelid.

Science in the news

"Do the vital interests of the United States require that a high priority be given to landing a man on the moon by 1970?" The American Association for the Advancement of Science asked that question of 2,000 of its members. Of 1,134 who answered, 31 per cent said yes, 62 per cent said no. Of those connected with space activities, 42 per cent said yes, 53 per cent said no. Most respondents thought 1975 would be more reasonable.

Meanwhile, our space program zoomed ahead. Following the triumph of the Ranger 7 moon shot (see page 15), a series of eight space shots was scheduled within a month, starting with the Syncom 3 communications satellite and ending with a Saturn superrocket shot to place a dummy Apollo mooncraft in orbit. Before the Ranger 7 shot, an Atlas-Agena rocket placed three satellites into orbits up to 63,000 miles from earth. Their purpose: to detect possible nuclear blasts up to 200 million miles from Earth.

Will an ion rocket work in space? This is a propulsion system in which ions--charged atomic particles of a fuel--are accelerated by electrostatic fields to provide thrust. Such an engine, designed by NASA, was sent into suborbital flight from Wallops Island, Virginia. It worked "extremely well".

While we're exploring the upper regions, we're not forgetting the nether ones. Four Navy men lived and worked for 10 days 192 feet under the sea off Bermuda. They endured pressure of 86 pounds per square inch, six times the pressure at the surface. Their home was a steel cylinder whose atmosphere contained helium instead of much of the nitrogen in air (nitrogen bubbles after it's depressurized, dulling the human nervous system). To explore the neighboring depths, they donned scuba gear and dropped through openings in the deck of the craft. One untoward effect: The lightness of the helium prevented their vocal cords from vibrating fully, so they sounded like Donald Duck.

Two new aviation gadgets promised smoother, safer flying. The Aerophysics Laboratory at Stanford Research Institute, Menlo Park, Calif., developed a radar system with a pulsating ruby laser beam to detect air turbulence even in a clear sky. And Pan American World Airways said it would install a navigation system in its planes based on the inertial guidance principle used in space shots and missiles. Gyroscopes, which show vertical and horizontal directions, are combined with devices that measure forward or sideways movement; a computer figures out from the measurements where a plane is.

President Johnson said the U.S. will soon have "the most advanced" reconnaissance aircraft in the world--the SR-71, from Lockheed Aircraft Corp., builder of the U-2 and A-11. He also announced plans for the "airborne equivalent of a jeep" for guerrilla warfare.

Science in the news

Efforts to solve the world's water shortage got a strong push from the White House. The President asked the Department of Interior to develop "an aggressive and imaginative program" to desalt water by using nuclear power. A recent study indicated water could be made available that way at competititve costs in coastal areas by 1975. Johnson now wants research translated into action.

Also in the White House, science advisors were reported figuring new ways to reform government support for science in colleges and universities. Most likely recommendation: Stop giving money to specific researchers and give it directly to the institutions. Purpose: to allay the fear that the schools are losing their autonomy.

Bodily functions and reactions made news. Pain-relieving phenacetin, in excessive doses,can damage people's kidneys. The Food and Drug Administration said a warning to that effect must appear on the labels of drugs containing phenacetin (the "P" in APC tablets)....Fat causes heart disease? It's doubtful, said a British nutritionist. Prof. John Hudkin said sugar might just as well be blamed. He based his finding on an analysis of the diets of 41 countries...Dr. Sheldon J. Segal of the Population Council and the Rockefeller Institute reported that hormone action can be duplicated in the uterus of a rat by RNA from other rats that has already been stimulated by hormones. The finding proved an earlier theory that hormones work through RNA....A new approach in genetic research was suggested by Dr. Ruth

Sager, of Columbia University. She offered evidence that genes can transmit heredity even when they exist apart from chromosomes, in which they're normally carried. Her experiments bore out a theory she presented last year and may help us understand the mechanisms of cancer and resistance to drugs.... And Dr. John McLeod of Cornell Medical School said tests showed that a hormone drug called medroxyprogesteroneacetate, when injected into men, made them sterile for six months.

Frozen tomatoes and avocados are just two examples of new products you may soon find in the freezer at your supermarket. The secret: The foods are sprayed with liquid nitrogen at temperatures as low as-320F. In the superquick freezing, no ice crystals form as when such foods are frozen by regular methods. No ice crystals, no mushiness.

New hope for the world's inventors: Today, they must get a patent in every country in which they want protection. The Department of Commerce proposes a U.S. effort to set up a patent system recognized by all.

CUSSEDNESS OF THE MONTH: The Roswell Park Memorial Institute of Buffalo, which has been investigating lung cancer, conducted one of the first smoking withdrawal clinics a year ago. Twenty men volunteered, members of the Institute staff. They were given lectures, nicotine substitutes and an appetite depressant. Five men have since moved from the area. Of the remaining 15, three never stopped smoking at all. And every one of the other 12 has taken up smoking again.

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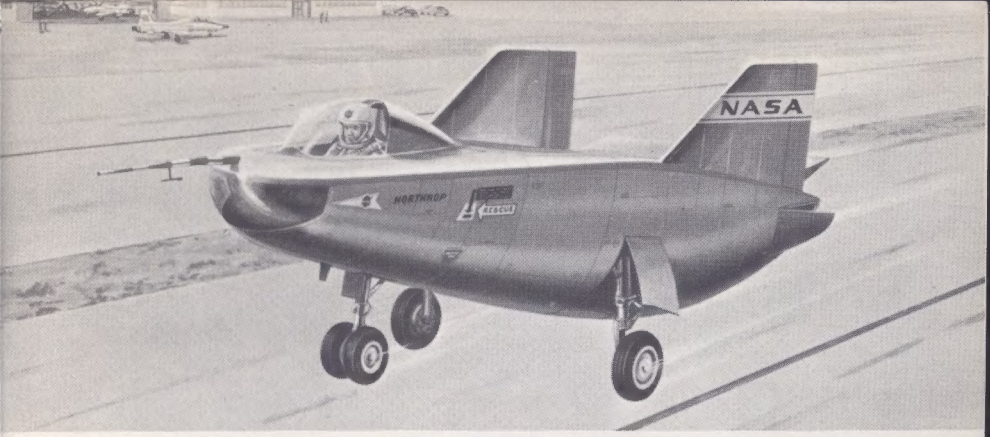

It just looks like a plane. The M-2 wingless glider will taxi space crews from satellite stations in space directly to home base, landing even more slowly than an airliner.

The plane that isn't

FLYING TAXIS from space may have a lot in common with the earthbound kind. They may sport twin tailfins and have just as many wings — none.

NASA is planning for when earth-orbiting space stations will need routine crew changes. It wants to avoid a complex and expensive mid-ocean recovery for every shipment of stale astronauts, so it has been developing two compact little taxis, the M-2 and the HL-10, to fly direct from space to home base. After a taxi has entered the atmosphere, it could be glided to any spot within 1,000 miles.

A preliminary version of the M-2 is 20 feet long, made of plywood and weighs 1,140 pounds. The gliders have a blunt nose for reentry, because a sharp nose would melt from air friction. Since they must fly after reentry, the gliders would ordinarily have wings, but like a sharp nose the sharp edges of wings overheat as well as add surface area. The more surface area the craft have, the more heat they generate. The solution: no wings.

Instead, the whole body is shaped to give lift. This saves weight and encloses the most useful space in the least surface area.

Next year, new versions will be dropped from 45,000 feet. The old plywood M-2 has already been dropped onto Rogers Dry Lake, Cal., from 10,000 feet. It floated in at 80 mph and rolled to a stop in less than the length of a football field. Wings? Who needs them?

HL-10 wingless glider drops from a pylon under the wing of a B-52 at 45,000 feet in this drawing of tests set for 1965.

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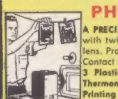

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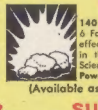

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